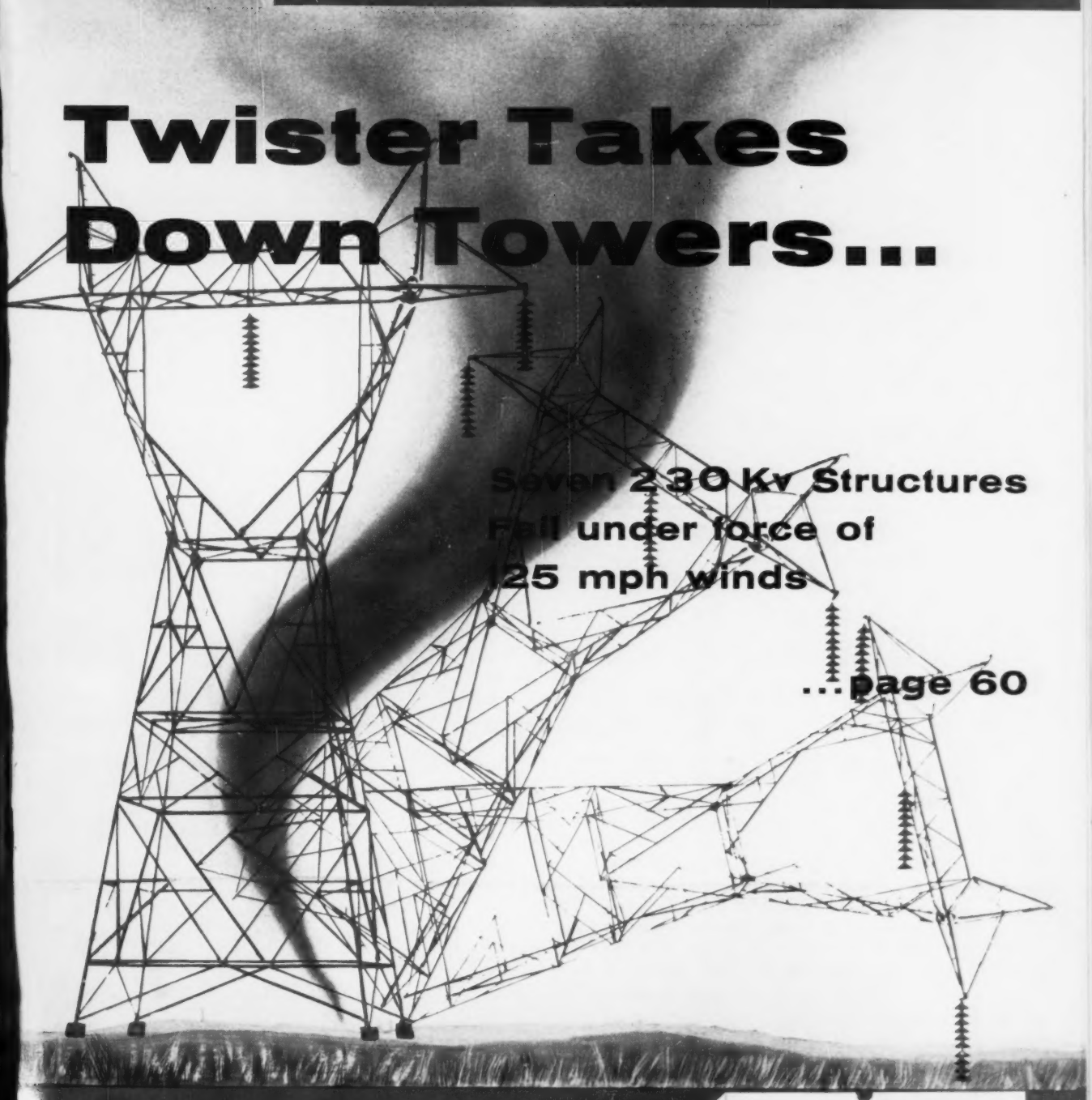
The Electrical Industry's Weekly Magazine

October 26, 1959

Electrical World

Price 50 Cents

A McGraw-Hill Publication



Twister Takes Down Towers...

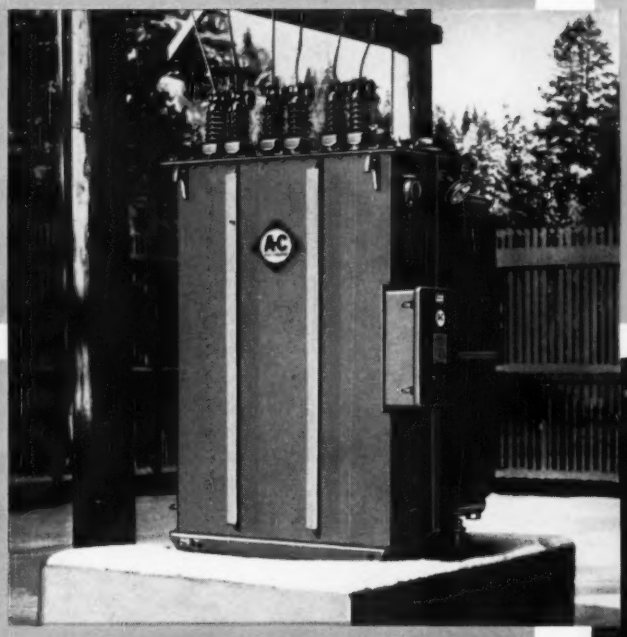
Seven 230 Kv Structures Fall under force of 125 mph winds

...page 60

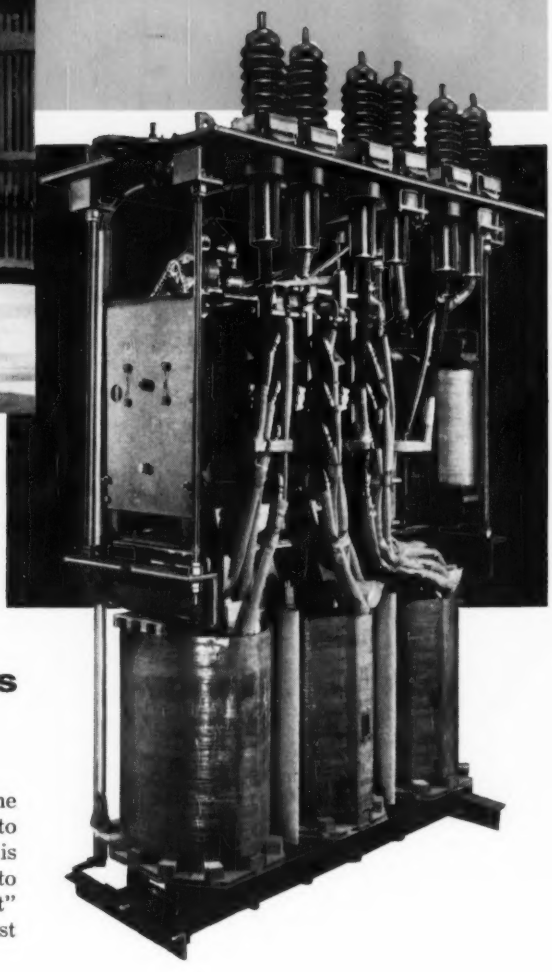
Inflation's Effect on Rates Explored by NARUC meeting . . . p 109

UNIV MICROFILMS INC
EDITORIAL DEPT
313 N FIRST ST
ANN ARBOR MICH

ALLIS-CHALMERS modern line for '59



standardized components
and unit design



why Allis-Chalmers 3-phase regulators

PACK MORE VALUE

Mass manufacturing of standard components — that's one reason why Allis-Chalmers can put so much value into industry's lowest-priced 3-phase regulators. Another key is *unit construction*. Simplified subassemblies are joined into a complete unit. Suspended from the cover, this "lift-out" unit makes interior readily accessible, assures you the best in construction.

More A-C regulator values: *Caliband* control, "Quick-Break" tap-changing mechanism, unidirectional breather and *Vari-Amp* rating.

Originators of 5/8% step regulators

Regulator facts fast! Call, wire or write...

ALLIS-CHALMERS

Caliband and *Vari-Amp* are Allis-Chalmers trademarks.

A-1164E

Electrical World

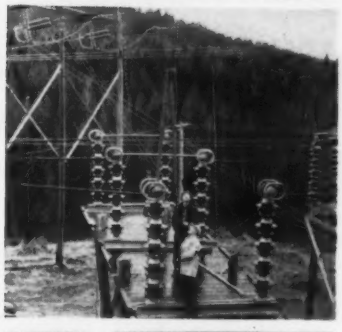
Vol. 152, No. 17 OCTOBER 26, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

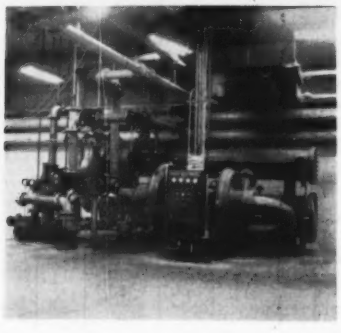
In This Week's Issue

p 52

p 58



p 62



CURRENT EVENTS

World Atom Power Agency Faces Facts

Engineers, economists at International Atomic Energy agency recognize need for more data on costs and sites....p 52

HEATING & COOLING

Waste Cooling Water Heats Power Plant

Roland E. Ott, Army Corps of Engineers

Reclaimed heat proves economical, reliable heat-pump supply for McNary, other Columbia River hydro plants....p 62

MANAGEMENT

Regulatory Commissioners Talk Inflation

Squeeze of rising costs is key issue at NARUC Convention. "Sell need for rate hikes," utilities told.....p 109

SUBSTATIONS

230-Kv Fuses Prove Economical

R. C. Safranek, Washington Water Power Co

Installation of 230-kv fuses to protect isolated loads serves to reduce capital expenditures .....p 58

Switch Trims Substation Protection Costs

S. A. Olson, Commonwealth Edison Co

Automatic grounding switch only 34% of the amount 138-kv oil breaker and local relaying would cost.....p 57

TRANSMISSION

Tornado Winds Topple Transmission Towers

Weather Bureau data is cited in explaining seven failures on Jamestown-Fargo 230-kv line.....p 60

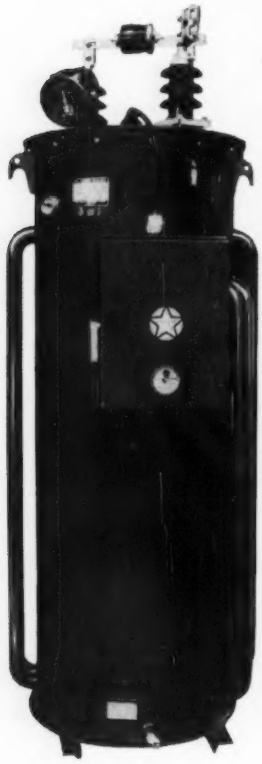
Departments

Editorial Comment 47
Electrical Week 11
Executive Reader 14
Letters 5
Management Newsletter ...109
Manufacturers Literature ... 89
Manufacturers News 78
Meetings Calendar 128
New Equipment 92
News About People.....114
Politics and Public Power... 12
Procurement & Products.... 74
Readers Service 98
Selling 102
INDEX TO ADVERTISERS...128

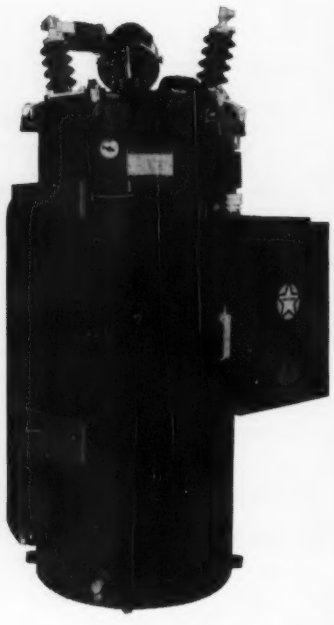
Not just a few "Introductory" Sizes...

Pennsylvania Pole Star Regulators

are available in all standard distribution ratings



POLE STAR Regulator for Platform or Pad Mounting



POLE STAR Regulator for Pole Mounting

27 single-phase distribution ratings for pole, platform, and station installations

Although new in itself, the single-phase Pole Star Regulator is a product of Pennsylvania Transformer's highly successful long-term experience in two related fields: distribution transformers and power-transformer load tap changers. As a result, Pennsylvania has introduced the Pole Star Regulator not in just a few initial ratings, but in a complete range of distribution sizes—a total of 27 different ratings for pole-top, platform and station installations.

2 service-proved tap changers for regulation in 32 steps of ⅝%

The new Pole Star Regulator combines Pennsylvania's patented Pole Star Distribution Transformer with two service-proved LTC mechanisms: a spring-drive LTC for current ratings 200 amperes and below, and a direct-drive LTC for higher current ratings. Each was chosen for its ability to deliver long-range economy and efficiency in its applicable ratings. Regulation is in 32 steps of ⅝% each.

"Mor-Amp" and other controls give maximum flexibility

An easy-to-use "Mor-Amp" feature permits regulating capacity to be increased to as much as 160% of rated current at reduced range. In addition, voltage level can be varied from 110 to 140 volts . . . time delay from 10 to 120 seconds . . . operating band from ¾ to 6 volts . . . and both reactance compensation and resistance compensation from 0 to 24 volts. Such flexibility permits adjustments to meet widely varying local conditions.

Want more facts . . . or a demonstration?

In the few months since it was introduced, the Pole Star Regulator has met with enthusiastic acceptance among many of the nation's leading utilities. If you are not yet familiar with this outstanding addition to the Pennsylvania line, write, wire or phone today for the complete facts, or to arrange a demonstration for your engineering and purchasing personnel. Distribution Sales, Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW-EDISON

VOLTAGE	KVA	Rated Capacity (Amps)	"Mor-Amp" Capacity (Amps)
2500	25	100	160
	37.5	150	240
	50	200	320
	75	300	480
	100	400	640
	125	500	668
	167	668	668
5000	25	50	80
	50	100	160
	75	150	240
	100	200	320
	125	250	400
	167	334	534
7620	11.4	15	24
	19.1	25	40
	38.1	50	80
	57.2	75	120
	76.2	100	160
	114.3	150	240
	167	219	350
	250	328	524
13800	34.5	25	40
	69	50	80
	138	100	160
14400	36	25	40
	72	50	80
	144	100	160

POLE STAR

Pennsylvania Distribution Regulators

Warren W Shaw Publisher

Charles F Hochgesang Editor
Daniel T Braymer Senior Editor

Engineering
Leonard M Olmsted Managing Technical Editor
Howard S Knowlton New England Editor, Boston
Edward Allen Midwestern Editor, Chicago
Francis J Kovalcik Methods Editor
Paul H Leech Western Editor, San Francisco
George Swift Associate Editor
Kenneth N McLean Northeastern and Industrial Editor
Leon A Allen, Jr Middle Eastern Editor
William R Shook Southeastern Editor, Atlanta
Archer E Knowlton Consulting Editor

News
Herbert R Frankel Managing News Editor
Thomas R Jordan Assistant Managing News Editor
Theodore Fuller News Editor
Michael G Duerr Assistant News Editor
John D Damon Commercial Editor
George B Bryant, Jr Manager, Washington Bureau

Special Services
Arthur J Stegeman Manager, Market Research
Dexter M Keezer Director, Economics Department

Production
Jesse A Mock Manager of Production
Frank C Stockman Art Director
H Tomlinson Howland, Jr Associate Art Director
Paul F Roman Associate Editor
Elizabeth R Parker Assistant Editor
Steven Ludwig Assistant Production Editor

Advertising
District Managers: W R Klein, L R Lawrence, D J Roberts, New York; L R Lawrence, Boston; F P Coyle, Philadelphia; M S Kearney, E F Coffey, Jr, Cleveland; E F Coffey, Jr, Detroit; M S Kearney, Pittsburgh; W H Meneilley and J T Schaefer, Chicago; J T. Schaefer, St. Louis; Russell Antles, Los Angeles; R C Alcorn and T H Carmody, San Francisco; Robert H Powell, Atlanta; F E Holland, Dallas; John Patten, Denver.
Otto A Drechsel Business Manager
John F Dugan Assistant Business Manager
Donald K Ellis Promotion Manager

E Bryson Sessions Circulation and Sales Service Manager

ELECTRICAL WORLD
Vol. 152, No. 17, October 26, 1959

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. **Executive Editorial, Circulation and Advertising Offices:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel below for information regarding subscriptions or change of address.

Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice-President; L. Keith Goodrich, Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Cond, President, Publications Division; Shelton Fisher, Senior Vice-President; John [illegible] Callaham, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Director of Advertising Sales; A. R. Venezian, Vice-President and Circulation Coordinator.

Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. Position and company connection must be indicated on subscription orders. Send to address shown in box below.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class postage paid at Albany, N. Y. Title registered in U. S. Patent Office. Copyright 1959 McGraw-Hill Publishing Company, Inc. All rights reserved. Permission required to reproduce any of contents. Printed in U. S. A.

SUBSCRIPTION AND ADDRESS CHANGES: Send subscription correspondence and change of address to Fulfillment Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.

LETTERS

"Rating Managers . . ." Stirs Interest

To the Editor:

You will recall that the August 10 issue of Electrical World carried a feature item entitled "Rating Managers by Job Standard."

You may be interested in knowing that we have had a number of inquiries from utility and nonutility companies around the country asking for further information on the subject. The five companies mentioned in the article have advised us that they, too, have been contacted for information. These inquiries indicate a widespread interest in the subject. They indicate, also, that a number of companies provide an extended distribution of your magazine within the ranks of management personnel.

Substantial credit must go to Michael Duerr for doing a very effective writing job. For a comparatively young man he evidenced the ability to grasp fundamentals that are usually the product of longer experience. And the interest that was aroused testifies to his aptitude for telling an effective story.

I. O. Mall
Ebasco Services
Two Rector St.
New York 6, N. Y.

Present Value—Another View

To the Editor:

I would like to take exception to your comment regarding fallacies in the present value method of determining rate of return. I have used the present value method for many years while employed by Pan American Petroleum Corp, and the criticisms which Mr. Baldwin makes in his article in the Harvard Business Review are not valid. The rate of return on an investment proposal is independent of the average earning rate of the corporation. It is the decision on whether or not to make the investment that is dependent upon the average earning rate of the corporation.

The method proposed by Mr. Baldwin for the solution of rate of return problems does, however, contain fallacies. It can be shown by simple examples that there are cases where increasing the project income decreases the rate of return if the rate of return is figured by Mr. Baldwin's technique.

Milton F. Searl
Atomic Energy Commission

This letter refers to an item carried on our "Executive Reader" page (EW, Sept 21). It, along with other letters, indicates we have hit upon a provocative subject. May we have other views?

NEW HONEYWELL CATALOG

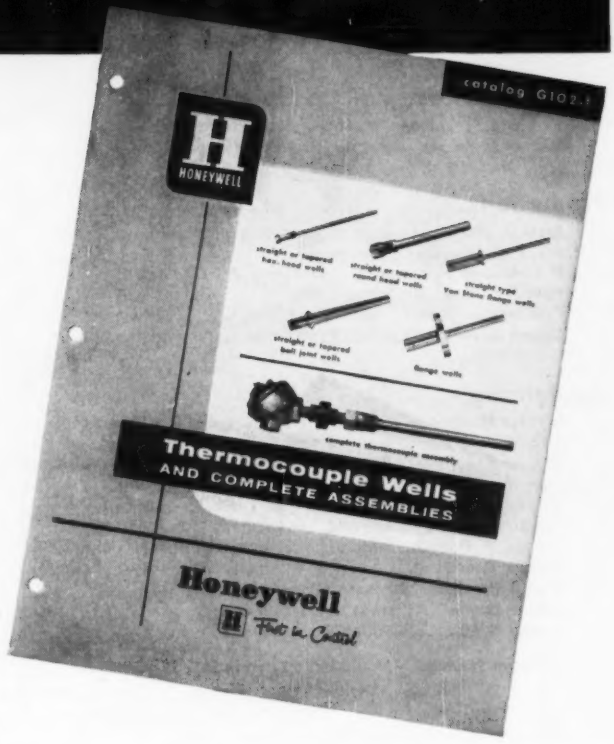
helps you choose the right

THERMOCOUPLE WELLS

Here's valuable help in the often-perplexing job of picking the right thermocouple wells and assemblies for particular applications.

This new Honeywell catalog brings you a wealth of useful data . . . provides all the information you need to make the right selection every time. Included in the catalog are:

- **Well designs and dimensions**
- **Pressure and temperature ratings**
- **Corrosion data**
- **Thermocouple assembly data**
- **Ordering and pricing information**



Honeywell

First in Control

FILL OUT AND MAIL THE COUPON FOR YOUR COPY—NO OBLIGATION

MINNEAPOLIS-HONEYWELL
Wayne and Windrim Avenues
Philadelphia 44, Pa.

Please send me a copy of the new Thermocouple Wells Catalog G102-1.

Name_____ Title_____

Company_____

Address_____ City_____ Zone____ State_____

NAUGATUCK PARACRIL OZO

THE OIL-RESISTANT, OZONE-RESISTANT NITRILE RUBBER

Now—the finest weather-resistant wire jackets can be Colored!

FOR SALES APPEAL • FOR SERVICE EASE

New Paracril OZO—a superior rubber compound developed by Naugatuck—makes possible *new eye appeal, new ease of identification.* And it outperforms standard wire jacket compounds many other ways, too!

Compare new PARACRIL OZO with other wire jacket rubbers. Prove for yourself new PARACRIL OZO gives:

- significantly superior ozone resistance
- greater fuel and oil resistance
- much greater abrasion resistance than standard jacket compounds
- excellent processability, with particularly fast extrusion
- *permanent retention of bright colors!*

If you are not already using PARACRIL® for your wire jacket compounds or similar products requiring such properties, chances are 1000 to 1 it's because you haven't yet *tried* PARACRIL OZO.

Why *not* try it—soon. Contact your nearest Naugatuck representative at the address below.

Naugatuck Chemical

Division of United States Rubber Company 1013P Elm Street Naugatuck, Connecticut

US RUBBER

Rubber Chemicals · Synthetic Rubber · Plastics · Agricultural Chemicals · Reclaimed Rubber · Latices · CANADA: Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ontario · CABLE: Rubexport, N.Y.

Out of Your Investment in Westinghouse Research Came a Great Advance in Network Transformers . . .

IN 1956 Westinghouse introduced the revolutionary Space-Miser network transformer—a compact design, 20% lighter in weight, that enabled utilities to save 15% in vault space for a given kva rating.

IN 1957 the Space-Miser design established itself as pacesetter of the industry.

IN 1958 as the rest of the industry rushed to match the new standards in economy, reliability and maintenance made possible by this new unit, Westinghouse extended Space-Miser design to the full range of EEI-NEMA ratings.

IN 1959 Westinghouse has continued to set the pace with refinements in Space-Miser tank design and by adding the exclusive Insuldur* insulation system.

FOR OVER THREE YEARS Space-Miser design has set the pace for industry progress with resulting benefit for every utility network system. This is a clear-cut example of how electric utilities' dollars, spent with Westinghouse, have reaped research and development dividends in increasingly efficient equipment.

For more information, contact your Westinghouse representative . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-70903

*Trade-Mark

SPACE MISER the network transformer that changed the thinking of an industry

SPACE-MISER NETWORK TRANSFORMERS changed industry thinking in . . .

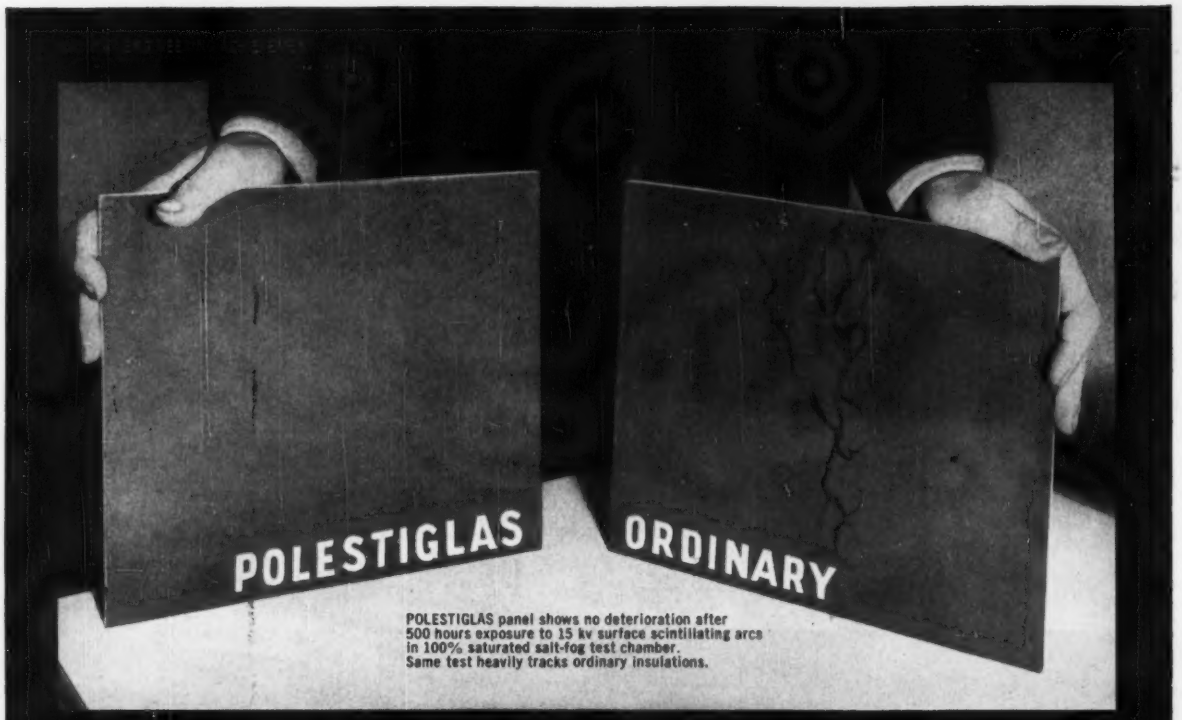
Maintenance Savings—Smooth-Form tank and Yukon coolers permit more uniform finish, simplify inspection and repainting, and reduce collection of corrosive deposits.

Installation Savings—Small size and light weight make handling easier, faster, safer. Required vault space is smaller. In addition, low height permits off-the-floor mounting without extra-cost excessive vault depth.

Improved Reliability—Insuldur insulation system permits 10° more overload temperature without additional loss of insulation life. Other features which boost reliability include superior design bushings, rotary disconnect and grounding switch and easily accessible high-voltage terminal chamber.

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS



POLESTIGLAS panel shows no deterioration after 500 hours exposure to 15 kv surface scintillating arcs in 100% saturated salt-fog test chamber. Same test heavily tracks ordinary insulations.

FEDERAL PACIFIC ANNOUNCES...

POLESTIGLAS*

IMPROVED INSULATION FOR METAL-CLAD SWITCHGEAR RESISTS TRACKING... GIVES NEW PROTECTION IN HIGH HUMIDITY AND CONTAMINATED AIR!

Integral casting of POLESTIGLAS (right) assures uniform bus insulation and eliminates hand-wrapped bends and offsets. Insulation is bonded to the bus bar to give void-free construction resulting in low corona loss.

Po•les•ti•glas...a cast or molded glass reinforced polyester...Provides superior insulation for metal-clad switchgear...Licks "problem" installations too tough for conventional insulation...Proves best insulation for use in areas of high humidity and contaminated atmosphere. **TEST RESULTS SHOW:** ■ Superior resistance to tracking ■ Reduced moisture absorption ■ Low, stable power factor in high humidity ■ Greater flame retardance ■ Low corona loss ■ High dielectric and impact strength. POLESTIGLAS ...another engineering achievement in Federal Pacific's program to better serve utilities and industry. Write for Bulletin 6025, Federal Pacific Electric Company, General Offices: Department 374, Newark 1, New Jersey. *Trademark of Federal Pacific Electric Company

FPE FEDERAL PACIFIC ELECTRIC COMPANY

The Best in Electrical Distribution and Control Equipment

The Electrical Week

LATE NEWS ▶

Largest electric load flow study ever undertaken is conducted by engineers of 15 companies—all Ohio Valley Electric Corp sponsors—in eight states. Purpose of Arlington, Va., study: Evaluate operations in supplying 2,000 Mw to AEC's Portsmouth plant.

Kamo Electric Co-op plans to seek REA loan for its first steam plant. Directors of the Vinita, Okla., co-op will up its debt limit from $20 million to $50 million, but it isn't known if this increase would all go for proposed plant. Size and site weren't announced.

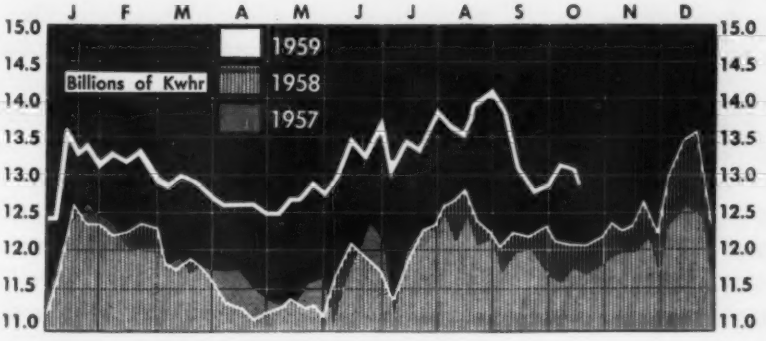
SEE Engineering Section Meeting . . . Utilities must use new generation concepts (gas turbines for short-time peaks, spinning reserve for loads between short peaks, and conventional high-efficiency high-load-factor units for continuous operation) to keep power costs down, says W. S. Ginn, GE vp—general mgr of Turbine Div . . . Dr J. A. Hutcheson, Westinghouse vp, urges use of new system planning concept, "powercasting," using system mathematical models, digital computers.

To virtually eliminate pressure rise in containment shells after reactor incident, Sargent & Lundy finds that storage of large quantities of cold water in shell and opening to shell atmosphere does the job. S&L tested the method this summer at Illinois Power's Hennepin plant. Study leads to new BWR plant design concept providing 5 to 10% savings, depending on plant size.

Southern Indiana G&E gets preliminary study permit for 45-Mw hydro plant at Indiana end of Army Engineers' proposed Newburgh dam across Ohio.

Management changes . . . Commonwealth Ed elects J. Harris Ward president, succeeding John W. Evers who retires Nov. 1. Willis Gale continues as chairman . . . Idaho Power elects D. S. Bailey vp.

WEEKLY POWER OUTPUT—Up 6.7% (Week ending Oct. 17), Kwhr 12,861,000,000



Per Cent Change From Previous Year

	Oct. 3	Oct. 10	Oct. 17
Total U. S.	+ 9.3	+ 8.4	+ 6.7
New Eng.	+ 7.8	+ 5.4	+ 4.8
Mid. Atlan.	+12.1	+13.1	+ 6.2
Cent. Ind.	+ 5.3	+ 6.1	+ 5.4
West Cent.	+ 7.1	+ 5.0	+ 5.9
Southeast	+ 7.4	+ 8.3	+ 6.5
South Cent.	+29.9	+15.0	+14.9
Rocky Mount.	+ 4.0	+ 2.5	+ 1.9
Pacific			
NW	+12.1	+ 9.6	+ 8.9
SW	+ 3.2	+ 6.8	+ 6.6

Seasonally Adjusted Index 251.5

Week Ago 255.4 Year Ago 235.4

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **Coal suppliers and haulers fight to keep a rate cut** which they hope will help maintain their share of utility market in East **(p 48)** . . . Dresden achieved criticality Oct. 15 **(p 49)** . . . Pineville, La., residents intrigued by Central Louisiana Electric's $370,000 executive building **(p 50)** . . . USSR visitors impressed by Soviet hydro progress **(p 51)** . . . Third annual conference of International Atomic Energy Agency takes realistic approach to economics, selection of sites, and reactor types **(p 52)**.

ENGINEERING ▶ **Substation protection with an automatic grounding switch** costs Commonwealth Edison 34% of what a 138-kv OCB and local relaying would cost **(p 57)** . . . Washington Water Power saves by protecting isolated substation loads with 230-kv fuses **(p 58)** . . . USBR cites Weather Bureau data to show tornado winds exceeding 125 mph toppled its seven Jamestown-Fargo transmission towers **(p 60)** . . . McNary Powerhouse is weather conditioned by heat pumps using waste generator cooling water **(p 62)** . . . A 325-ft converted LST brings wood poles on trailers from Norfolk, Va., to Camden, N. J. in a "fishy-back" operation recently begun by Public Service E&G. It saves at least $2 per pole **(p 67)** . . . At its Kansas City meeting, the System & Equipment Committee of EEI heard that utility company

Politics and Public Power

FUEL SUPPLIERS GIRD FOR BATTLE

Electric utilities have a stake in the gathering contest in Washington between the beleaguered coal industry, and its fuel oil, and natural gas competitors.

The battle is being joined with every passing day. And the market the two eye most enviously is the fueling of utility steam plants. The most acute dispute is being carried on at the Interstate Commerce Commission, where coal is seeking lower freight rates that it says are needed to keep the eastern markets it now holds. And, as expected, oil is disputing the discount freight and mine-head price schedule (see page 48).

But a longer range contest is going on, as well. There are two major factors:

- Coal's long-term illness, and efforts of the new national coal policy conference to find a remedy.

- The Administration's compulsory oil imports program, which attempts to regulate deliveries of foreign residual fuel to the U. S., particularly in the East and New England.

The coal policy conference was established earlier this year, with representation from the coal mining interests, the United Mine Workers Union, and from major users, personified by Philip Sporn, president of American Electric Power Co. Its philosophic aim: to find a way for coal to maintain its place in the economy, and to persuade the federal government not to give preferential assistance to competing fuels. Sporn's main fear is that too much government emphasis on atomic power development may work against development of coal, oil, and gas.

Other officials identified solely with coal

difficulties in recruiting young engineers stem from secondary schools (p 54).

PROCUREMENT & PRODUCTS ▶ **Best chance to prevent a recession in 1961** is for businessmen to act sensibly, says McGraw-Hill's Economics Dept (p 74).

MANUFACTURERS ▶ **Allis-Chalmers shows fuel cell-powered tractor** . . . GE says "Operation Sunrise" is on schedule . . . Kaiser delivers enamel-coated pipes to Southern California Edison (p 78).

NEW EQUIPMENT ▶ **Units substations control primary power to secondaries** at point of use . . . Capacitor racks for 50-kvar capacitors are available in single row and cluster-type racks (p 92).

MANAGEMENT ▶ **Inflation gets plenty of attention from regulatory personnel** at 71st N.A.R.U.C. Convention. Commissioners show a growing realization that attrition of the dollar must be considered in rate cases, but ask utilities to show them more evidence and do a better job of educating the public (p 109).

SELLING ▶ **Westinghouse opens seven Total Electric Homes around U.S.** (p 102).

see threats from national policies as established by the imports control program, and by Federal Power Commission regulations over use of natural gas for industrial purposes.

The coal program for this year had a short-term aim: to get from Congress a national fuels policy study. The effort was thwarted at the end of Congress, and coal blamed competing fuels for the failure.

Joseph E. Moody, president of the National Coal Policy Conference, charged before a hearing of the Congressional Joint Economic Committee that "opposition by the oil and gas industries to a national fuels policy study would amount to taking the fifth amendment." That is how rough the fight is becoming.

Oil and gas officials warn against any further limitation of oil and gas markets, because costs would go up, and economic progress would be stymied.

The Independent Natural Gas Assn of America says the coal industry only wants to curtail gas use. "Their so-called national fuels policy," says the association, "has as a principal purpose the curtailment and prohibition of the use of natural gas."

Oil has had support in the past from coal-mining states in Congress. Now the coal industry is inclined to withdraw, and fight directly against its competitors. The schism could develop in Congressional debate over minerals depletion, over oil imports legislation, over general business policies.

Coal says it doesn't want a fight with other business over markets that are demonstrably better served—diesel for locomotives, for example.

But it is girding for a fight on markets such as electric steam plants, and will make itself heard from now on in.

Nuclear Notes

A two-day symposium on nuclear fusion, sponsored by the Texas Atomic Energy Research Foundation and the University of Texas, will be held in Austin Nov 20-21. The foundation, sponsored by 11 investor-owned electric utilities operating in Texas, is seeking to advance knowledge of nuclear energy through research, experimentation, and education.

A table size purifier for atomic reactor fuels with a capacity of refining 5 tons of uranium a year, has been designed at ASEA's atomic laboratory. The uranium or plutonium is separated from impurities by extraction with organic solvents. More compact and cheaper than plutonium separation plants of the Great Powers, the new apparatus is likely to reduce cost of refining uranium and particularly plutonium substantially.

Possibility of stretching burnup of Magnox canned fuel elements from 3,000 to 4,500 MWD per ton is being weighed in Britain, according to Sir John Cockcroft. There is often enough activity to spare in large graphite-moderated reactors to justify extension, he said, but it calls for greater understanding of residual preferred orientation in the fuel, and cavitation in canned materials. The future of fuel elements lies in the ceramic field, Sir John said.

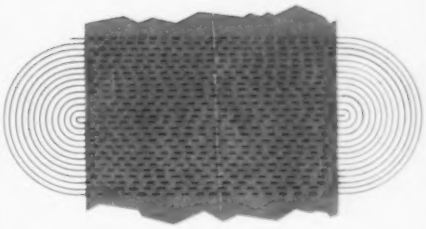
A technological breakthrough in fabrication of zirconium has been accomplished by Harvey Aluminum. The company is now producing Zircaloy-2 alloy tubing for nuclear reactor that is 51½ ft long, the longest zirconium extrusion ever made. Previously, the tubing was made by welding three smaller extrusions together.

Watch for postponement of the planned nuclear power station at Geertruidenberg, Netherlands, just announced. It was to have had a capacity of 150 Mw, cost 200-300 million guilders, and be completed by early 1961. Decreasing coal prices in Europe have removed justification for such an expensive energy supply station.

AEC's Nuclear Power Station Training Program for reactor supervisory personnel at Shippingport has been revised to require completion of six months training in operation of test and research reactors as a prerequisite. This experience may be obtained at either Commission or industry sites here or abroad.

H K Ferguson Co has been picked as construction contractor for AEC's Experimental Gas-Cooled Reactor (EGCR) at Oak Ridge. It is a combined experimental and power demonstration reactor designed for generation of about 25,000 kw.

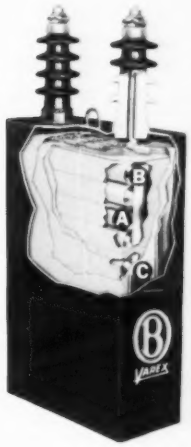
It's So Simple with Springs!



Schematic end view of Varex shows contact plate in relation to element. Note that each layer of foil contacts the plate at top and bottom.

Strong springs (c) maintain constant pressure on contact plates (b) to hold against extended foil (a).

VAREX spring-pressure system provides large contact areas outside active dielectric



An obvious design advantage in Varex capacitors is the method of making contact with the extended foil at the end of each element. Contact is maintained by strong spring pressure. This leads to these important benefits:

1 - - The electrical contact areas are generous in size and large in number. Every turn of foil is in contact both at the top and bottom of the plate. With this arrangement, current density at any single point is necessarily low . . . Varex units are better equipped to handle transient overcurrents.

2 - - With this system, winding each Varex element can be a continuous process - - uninterrupted for insertion of foreign materials to make electrical contact to the foils. A possible cause of mechanical damage to the paper dielectric is eliminated.

It's benefits like these - - adding to capacitor life and safe-guarding operation - - that argue strongly for using Varex capacitors on your system.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

4963-H1

. . . so vastly improved it meant

It became evident several years ago that we couldn't make our new Futura suspension insulator at competitive prices unless we had a better way to produce it - - a new, high-capacity production line providing an unusually high degree of quality control, product uniformity.

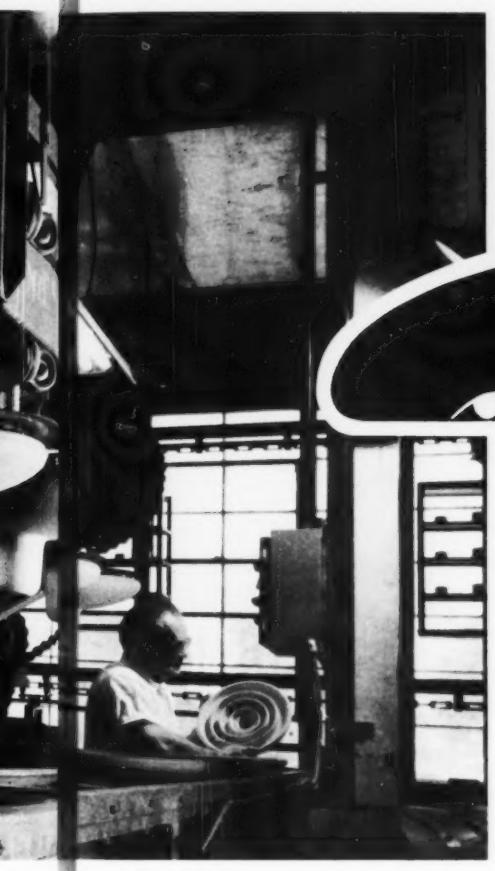
Toward the creation of new production facilities, therefore, we directed the same intensive engineering effort that perfected the Futura C.I.S. insulator itself.

The result was a new, mechanized facility as unique as the insulator it produces. One end of its mile and a quarter long synchronized conveyor is presently being charged with 2800-pound loads of raw materials every few minutes. The other end discharges finished and fired porcelain shapes ready for assembly.

The picture above shows a vacuum-lift transfer movement, typifying the delicate, precision handling which makes possible the highest degree of controlled uniformity.

In both product and production line, O-B engineers have thus created new, imaginative applications for proven materials and familiar techniques. *That's* why the Futura suspension insulator is so vastly improved . . . and why it doesn't cost more.

nt a new factory!



FUTURA

with CIS⁎

⁎Corrosion Intercepting Sleeve

"look ahead" benefits you can afford today:

- safety from corrosion failure - - proved safe by 15 years' service (to date) in locations where other insulators are failing in one to five years.
- "miniaturized" design of units rated 18,000, 25,000, and 36,000 pounds offers greater mechanical strength with less weight.
- greater electrical strength - - resistance to 60% steeper impulse wave, 10% higher 60-cycle puncture.

OHIO BRASS COMPANY, MANSFIELD, OHIO

GOLDEN ANNIVERSARY
1909 · 1959
MODERN SUSPENSION INSULATOR

Ohio Brass Ⓑ **HOLAN**

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

4963-H

Deadends go up fast

Captive keeper-piece, long U-bolts, streamlined design, speed installation of O-B Stratelines

Building distribution deadends becomes greatly simplified when O-B Strateline clamps are used.

Among the many time-saving features are long U-bolts which permit positioning conductor under the keeper-piece without removing the nuts. The keeper-piece, incidentally, is permanently attached to the U-bolts.

The streamlined design makes the clamp easy to cover with rubber goods for hot-line work. In fact, the all-around suitability of the clamp to hot line work was thoroughly tested by makers of hot line tools before the design went into production.

Six sizes of the aluminum Strateline series handle all conductors between .15 and 1.55 inches in diameter.

We can point to other quality features like the way the nuts and bolt ends are rounded to impede corona, the large tackle loop and the wide clamp mouth, but we believe the point has been made. If you like clamps of the Strateline type, you can't do better than an O-B Strateline.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

*GraybaR QUALITY SINCE 1869 *REG U.S PAT OFF

This product distributed by *GraybaR ELECTRIC COMPANY

Ohio Brass ®

HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

4963-H

GOOD NEWS in aluminum construction . . .

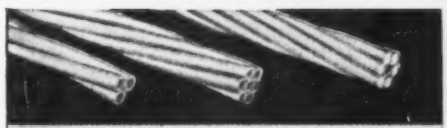
ALUMOWELD

Aluminum-Covered Steel Wire and Strand

Alumoweld was developed to cut costs and improve performance of overhead ground wire, ACSR conductors, guy and messenger strand. Its thick aluminum covering —25% by area—gives Alumoweld corrosion resistance equal to solid aluminum wire and 33% of the electrical conductivity.

When used as overhead ground wire, remember that Alumoweld is just as strong as steel, is 18% lighter in weight, and has 3 times the conductivity. These advantages permit greater mid-span clearance, and make Alumoweld excellent for relaying and for discharging lightning currents to ground. For guys and messengers, Alumoweld Strand provides the full strength of steel and will last far longer.

These valuable properties also pay off when Alumoweld is used as core wire for ACSR conductors. Here, Alumoweld eliminates the hazard of dissimilar metals in contact, provides increased conductivity and gives you an extra-high-strength core wire that matches the life of the solid aluminum wires. For the complete story, send for Bulletin E.D. 3000.



Two Exclusive features of **ALUMOWELD**

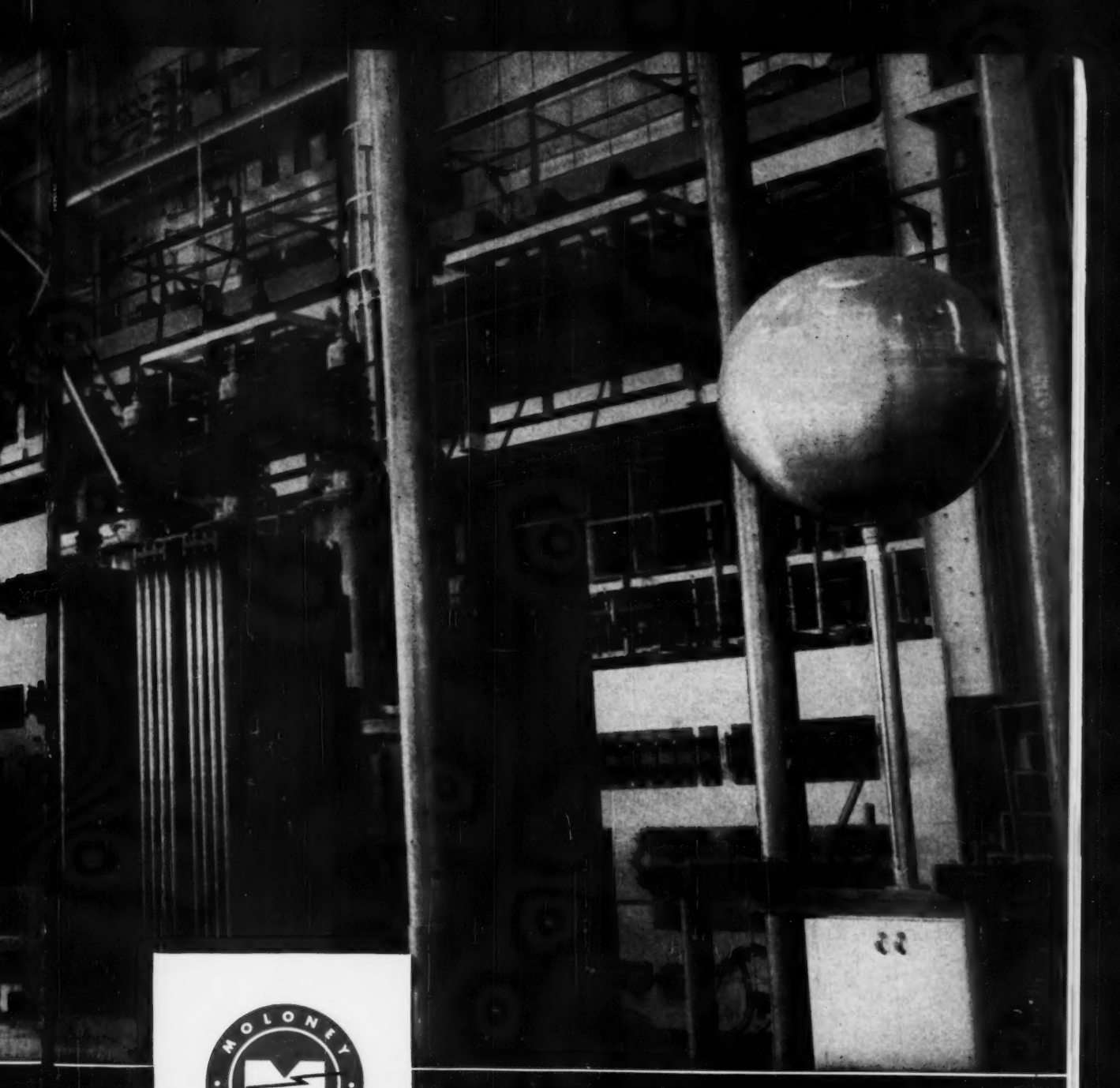
Alumoweld's thick aluminum covering will never crack, flake or peel. Applied by an entirely new cladding process—the controlled atomic weld —the heavy aluminum covering and the high-strength steel core are inseparably interlocked by a ductile weld that remains permanent under all operating conditions.

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION, GLASSPORT, PA.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

PROVING GROUND



The "Proving Ground" for Moloney Power Transformers is this large, fully-equipped test area suitable for testing the largest of transformers.

Each Moloney Power Transformer undergoes thorough tests to prove that it meets industry standards and Moloney's high standards of quality and performance.

Thus, the test bay shown here can aptly be called the proving ground for future performance . . . the payoff of constant research and development programs.

Specify power transformers that are designed, built and proven to give efficient, dependable performance . . . Specify Moloney Transformers, All Along The Line.

MOLONEY ELECTRIC COMPANY

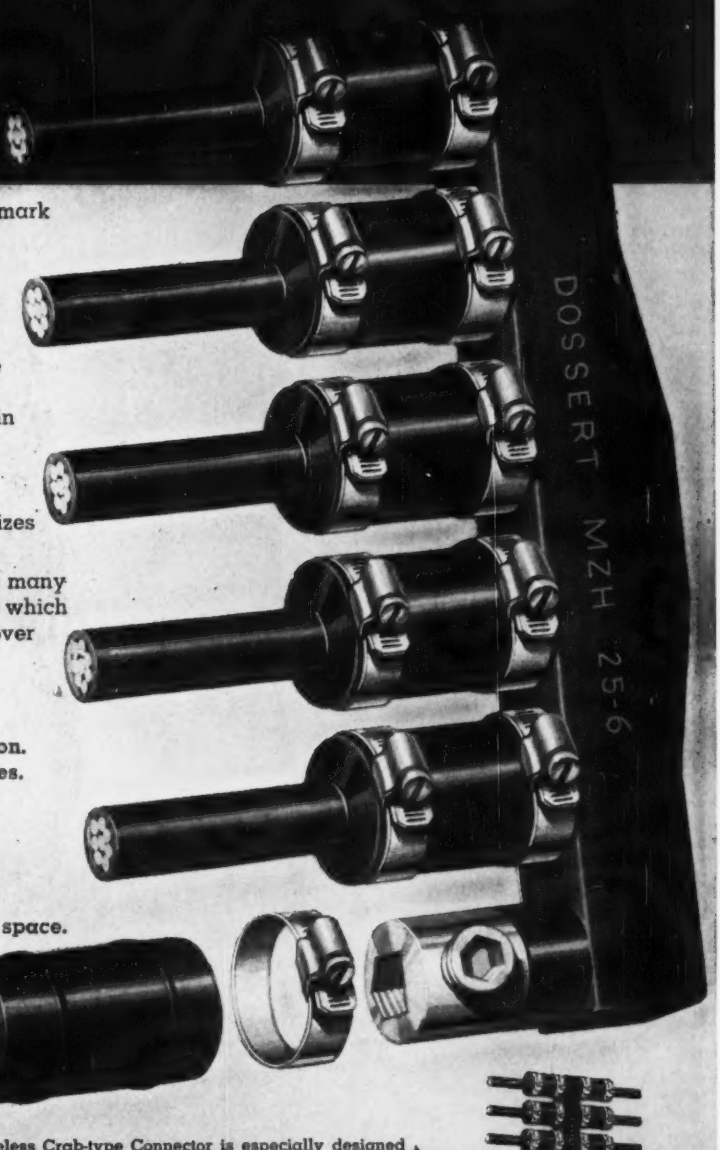
Manufacturers of Transformers for Utilities, Industry and Electronic Applications

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

DOSSERT MICON*

(Tapeless Underground Connector)

More COMPACT
More RELIABLE
LOWER in COST

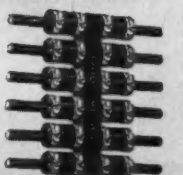


MICON is a Dossert Mfg. Corp. trademark for a tapeless underground connector especially designed for residential and industrial underground distribution systems. This brand of connector is fully insulated for joining up to 8 electrical cables where watertightness must be insured. MICON tapeless connector is simple in concept and well proven principles have been used in its design. No extra components are needed to accommodate a wide range of cable sizes in any outlet position.

MICON brand tapeless connector has many outstanding features and advantages which constitute a substantial improvement over older style and competitive fittings. The most important ones are:

- Lower cost of complete fitting.
- Less field time required for installation.
- Wide cable range without accessories.
- No plastic parts to crack or chip.
- No extra bushings required to fit different insulations.
- All parts are designed for easy accessibility and easy installation.
- Compact design conserves manhole space.

Dossert MICON brand tapeless Crab-type Connector is especially designed for joining up to 12 electrical cables. This connector is an original Dossert design and adheres to the same principle as the tapeless type. Write for special catalog.



*Pat. Pend. Reg. Trade Mark applied for

Request also complete UNDERGROUND CATALOG UG 53-1

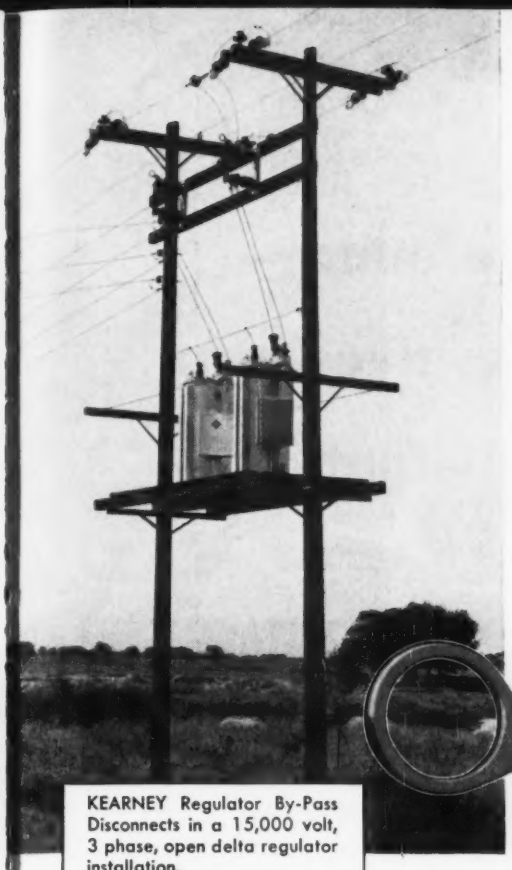
50

DOSSERT MFG. CORP.

249 Huron Street, Brooklyn, New York

Safe performance

of 4 operations in proper sequence assured by KEARNEY REGULATOR BY-PASS DISCONNECT



KEARNEY Regulator By-Pass Disconnects in a 15,000 volt, 3 phase, open delta regulator installation.

- **no danger of accidentally dropping load**
- **no hazard from interrupting exciting current**

With the same motion—in the same time—required to open *one* conventional disconnect, the KEARNEY Regulator By-Pass Disconnect:

shunts the line leads to by-pass the regulator—opens both leads to the series winding—safely interrupts the exciting current.

What's more, you realize substantial savings in cost of switches, installation time, supporting structure and leads, because *only one* KEARNEY By-Pass Disconnect is needed for each phase of a regulator installation, compared to *three* single-throw disconnects. And the operator has *maximum safety*, since all switches can be located on the same side . . . visible from one point!

JAMES R. KEARNEY CORPORATION, *General Offices:* 4224-42 Clayton Avenue, St. Louis 10, Missouri

34

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify

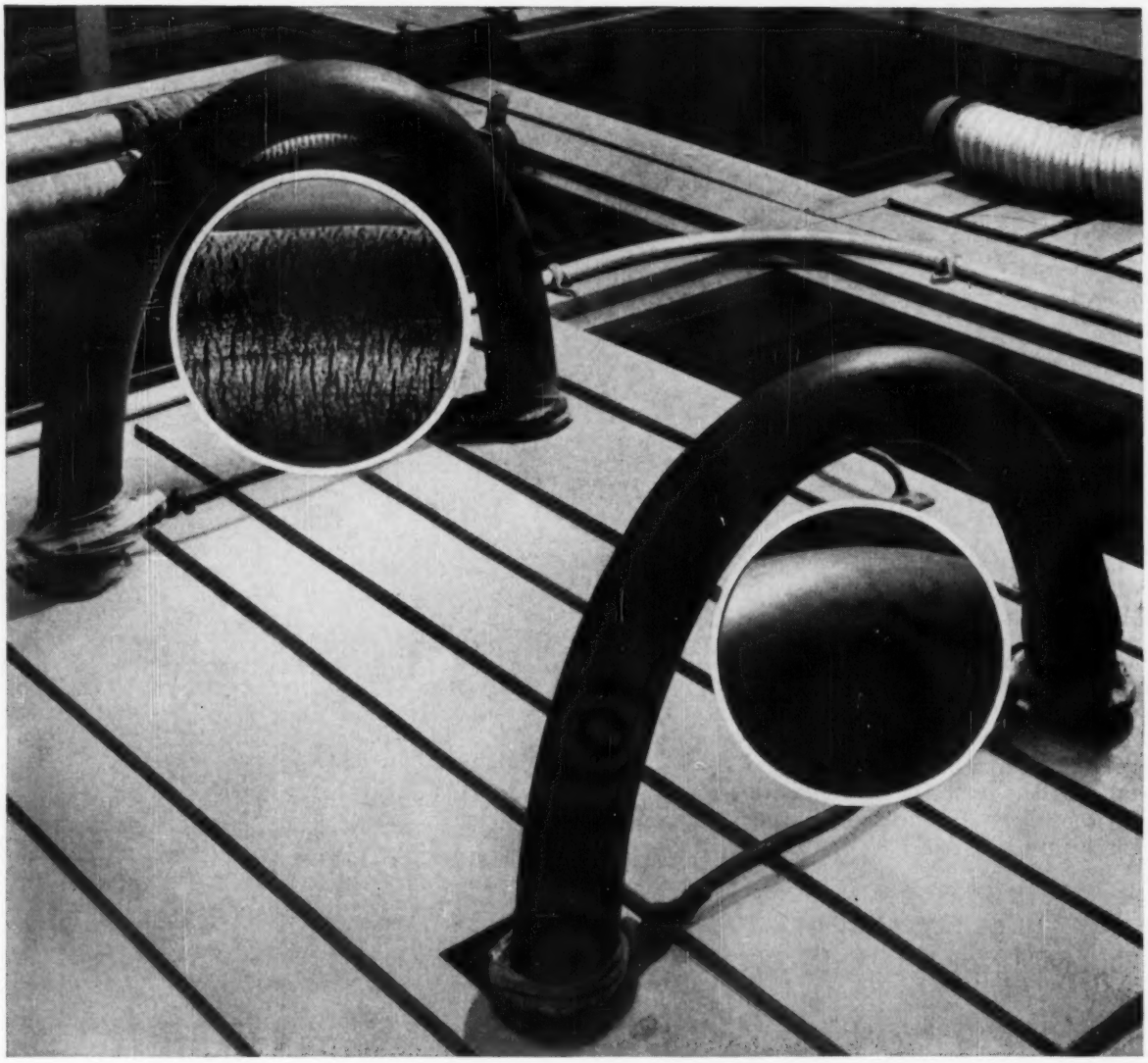
KEARNEY PRODUCTS

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

The Mark of Quality

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IOWA—GUELPH, ONT., CANADA

24 years under the sun: only neoprene jacketing gives you this time-proven reliability



24-year test. January, 1935, cable jacketed with neoprene and natural rubber were placed in this outdoor proving ground. The cable samples were bent to put stress on the jackets, increasing the jacket's vulnerability to ozone cracking.

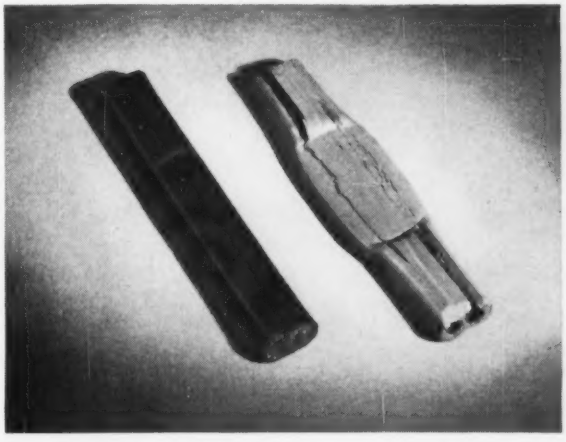
Today, the natural rubber has almost no physical strength. But the important point is this: after 24 years in the sun and weather, the neoprene jacket is still lively and tough . . . no cracks . . . no visible deterioration.

Neoprene's performance as a jacketing for wire and cable is backed up by over 20 years of actual service . . . service that has gained neoprene a reputation for reliability and long-term economy.

Neoprene's reputation has been earned by a combination of properties that make it unequaled by any other jacketing material. Neoprene resists:

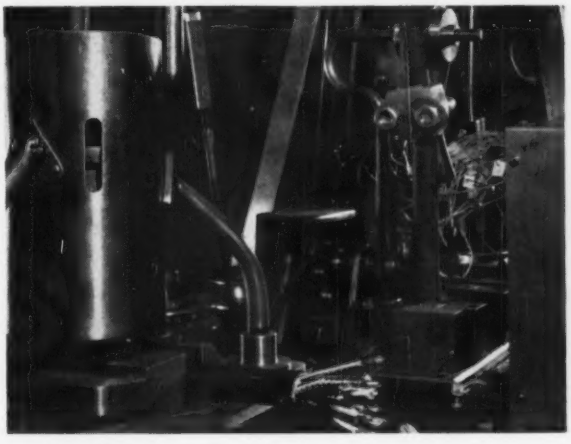
Weather, sunlight and aging
Wide temperature variations
Flame, ozone, corona
Oil and grease
Many organic and inorganic chemicals
Soil acids and galvanic action
Impact, gouging, cutting

Neoprene's time-proven dependability is your guarantee that above or below ground, you can be confident of long service life, long-term economy when you specify neoprene.

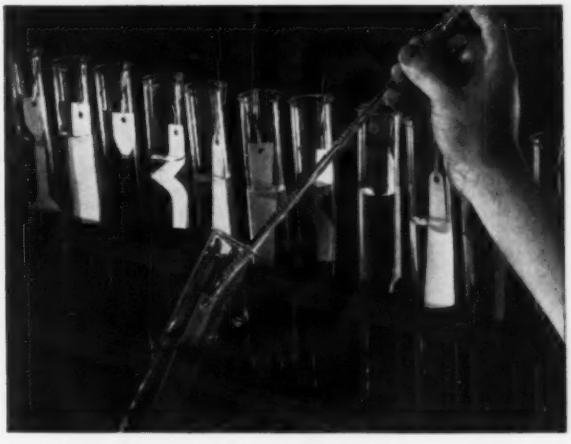


No plastic flow with neoprene. At high temperatures some jacketing materials soften and flow, making cable vulnerable to abrasion and impact damage. Neoprene is vulcanized, does not revert and flow at high temperatures. (Sample compressed 8 hrs. @ 75 psi @ 302° F.)

Low temperature flexibility with neoprene. At low temperatures, neoprene remains flexible and resilient. This property helps insure the cable jacketing material against damage from impact or twisting at subzero temperatures.



Outstanding impact resistance with neoprene. It protects cable from damage by impact, cutting and gouging. This impact tester wallops the cable jacket. No other jacketing material takes this test as well as resilient neoprene.



Chemical resistance with neoprene. Its resistance to a wide range of chemicals is valuable in industrial applications. In underground installations neoprene resists soil acids and prevents deterioration from galvanic action.

DU PONT
REG. U. S. PAT. OFF.

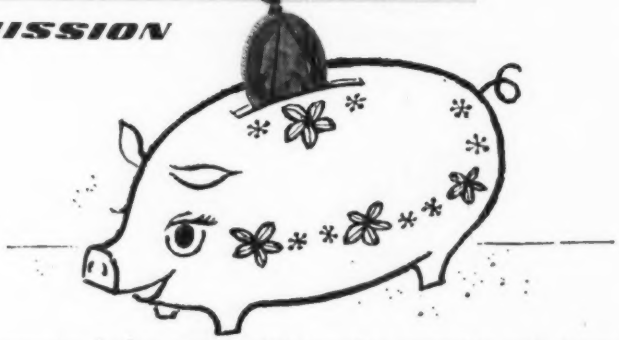
SYNTHETIC RUBBER

NEOPRENE
HYPALON®
VITON®
ADIPRENE®

Better Things for Better Living . . . *through Chemistry*

THE ALOUETTE SAVES REGULARLY...

ON EVERY MISSION



In transporting, hauling, spraying, aerial inspection, construction work, stringing wire, or at nearly any job, the turbine-powered ALOUETTE II — operating in heat or cold, at high or low altitudes — SAVES DOLLARS.

PROOF: Check these facts:

- ✻ *An Alouette sprayed an acre of brush along a remote powerline right of way in only 20 seconds for $7.26*
- ✻ *An Alouette transported four surveyors 20 miles to a 9,000 foot mountain landing at a total cost per man of $12.50*
- ✻ *An Alouette lifted and carried a 900 lb. seismographic drill rig 2 miles for $5.00*
- ✻ *An Alouette strung 8,000 feet of 3/8 inch steel cable in 1 hour and 40 minutes for $210.00*
- ✻ *An Alouette erected 30 telephone poles in 1 hour and 10 minutes at a total cost of $175.00*

Regardless of the task or climate . . . the low-maintenance Alouette brings ECONOMY to helicopter operations. Contact Republic's Helicopter Division for complete details on any of the above missions and on how the Alouette can help fill your needs.

*Designed by Sud Aviation

The Alouette is assembled, tested and distributed by:

REPUBLIC AVIATION CORPORATION

HELICOPTER DIVISION

Farmingdale, Long Island, N. Y.

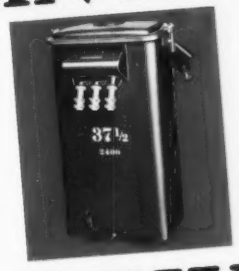
Free Gifts To Celebrate L-M's Transformer *Silver* Anniversary

Cash award and new transformer for utility;
200 Toastmaster appliances for 25-year utility veterans

Do you know of an L-M transformer that has been on your system about 25 years? If the serial number is over but still close to 50,000 you may have the winner. If your company turns in the oldest L-M transformer still in operation, you can win $500 for your employee benefit plan, and a new 50 kva L-M Round-Wound transformer.

If you are celebrating your 25th year of employment with a utility, you are eligible for one of the 200 Toastmaster appliances being given away to people hired by a utility during 1934—the year L-M went into the transformer business. Nothing to buy, no jingles to write! Just fill in the entry form and keep your fingers crossed.

WANTED!



$500 REWARD

OLDEST L-M TRANSFORMER

Oldest transformer made by Line Material Industries. Still at large.

DESCRIPTION

AGE: Approx. 25 years
HEIGHT: Approx. 3 to 4 feet
WEIGHT: Medium • BUILD: Rugged
OCCUPATION: Volt Changer
DISTINGUISHING MARKS:
L-M Nameplate clearly visible.
Serial No. 50,000 or above.

RECORD: This transformer has been in operation for 25 years. It is in original condition, not uprated or rebuilt.

CAUTION: This unit is energized and is extremely powerful.

Please furnish any information which may assist in locating this individual unit to the Director of TBI or nearest TBI field office.

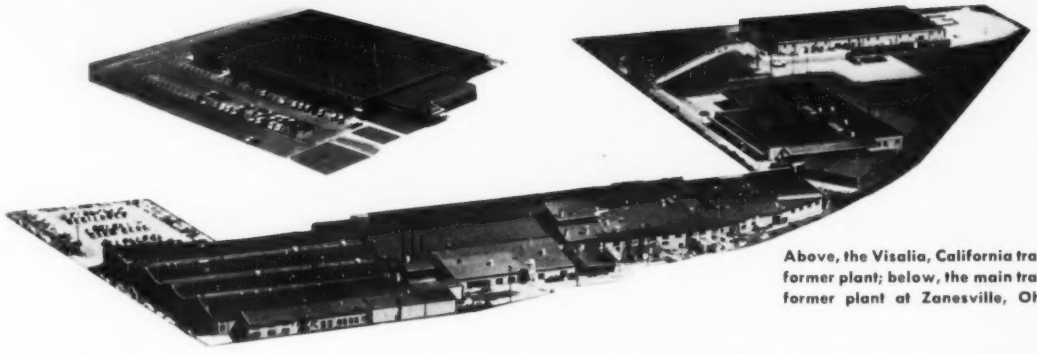
LINE MATERIAL INDUSTRIES
Milwaukee 1, Wisconsin

A. R. WAEHNER
Director, Transformer Bureau of Investigation

COMPLETE DETAILS ON PAGE 4

QUARTER CENTURY OF TRANSFORMER DESIGN RECALLS MANY L-M CONTRIBUTIONS

Silver Anniversary



Above, the Visalia, California transformer plant; below, the main transformer plant at Zanesville, Ohio.

L-M makes many contributions in 25 years of Transformer Design

1934: **L-M . . . the smallest transformer manufacturer in the industry**

1959: **L-M . . . the third largest producer of distribution transformers**

Back in 1934, Line Material had been in business for 23 years making a variety of distribution items for electrical utilities. With ambitious hopes and an earnest desire to offer even better products to the industry, L-M added distribution transformers to its line of products. Through the purchase of an existing transformer manufacturing company, L-M acquired ability, practical experience, and the services of some young engineers with new and then untried ideas.

A New Design Principle . . . In this atmosphere of youth, sincere ambition, and eagerness to do something better—which has always characterized Line Material—an entirely new, completely unorthodox, idea was born. This, today, is known as the Round-Wound transformer.

The Round-Wound transformer, with its exceptional and entirely unmatched performance characteristics, has been a major contribution of this company to the art of distribution transformer design.

Hundreds of L-M Developments . . . Line Material's research and development engineers have made literally hundreds of contributions to distribution equipment and practices. In distribution transformers, whose silver anniversary L-M is celebrating, are many that are well known to industry engineers and executives.

Oxidation-Resistant Transformer Oil . . . L-M was the first to introduce ORTO, an inhibited oil, as an aid to increased transformer life. The idea was soon quickly adopted by almost every manufacturer.

Obround-Smaller, Lighter . . . Line Material first introduced the obround tank shape, which made it possible to reduce size and weight without sacrificing performance characteristics.

L-M's Pad-Mount—The Better Way! Line Material was the first to design an aboveground transformer for underground service. L-M's Pad-Mount Transformer is generally recognized as a major contribution among those utilities facing the problem of developing underground distribution systems at the lowest possible cost.

Then—L-M SRT! Line Material's Self-Regulating Distribution Transformer is another outstanding L-M engineering development that still has not been matched in the industry.

Ask The L-M Field Engineer! L-M employs few "salesmen." Its men are *Field Engineers*—technical men with engineering degrees whose interest and responsibility are to serve the customer. That's why we always suggest, "Ask The L-M Field Engineer."

We say it now: Ask him—for information about Line Material, its services, its products, and especially, in this Silver Anniversary year, about the outstanding distribution transformers that are the proud product of this progressive, customer-minded company. Line Material Industries, Milwaukee 1, Wisconsin.

"Round-Wound," "ORTO," "Pad-Mount," and "SRT" are trademarks of Line Material Industries.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

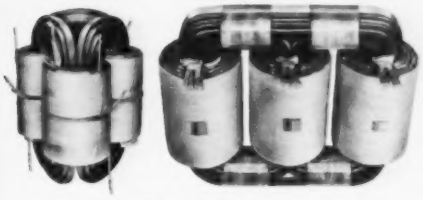
SOME L-M CONTRIBUTIONS TO TRANSFORMER DESIGN

ORTO (OXIDATION-RESISTANT TRANSFORMER OIL)

Line Material was the first to introduce an inhibited transformer oil that resists oxidation, acidity, and sludging. ORTO lasts several times as long as conventional transformer oil thus assuring longer transformer life. The advantages of this contribution were recognized and thereafter adopted by all major transformer manufacturers.

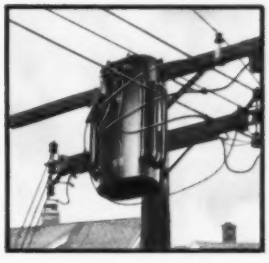
ROUND-WOUND TRANSFORMER

Round-Wound, is the first and only transformer with uncut, wound core and round coils wound directly on the core. This *Round*-coil, *Wound*-core is a balanced design that provides optimum overload capacity, long life, low losses, low exciting current, exceptionally good cooling, low regulation and exceptional mechanical features.



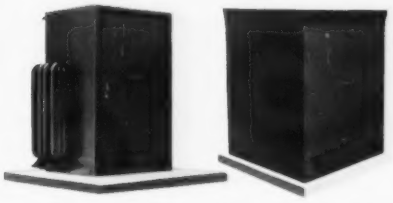
THE WOUND THREE-PHASE CORE

Other L-M firsts are the "Tri-Wound" and the "Uni-Wound" in three-phase designs. There are not just three single-phase cores in one tank. This continuously wound unitary core with round coils combines reduced size and weight with improved efficiency.



OBROUND TRANSFORMER TANK

This innovation in tank manufacture reduced overall size and weight without reducing performance. The obround shape brings the center of gravity closer to the pole. This combination of lighter weight and shorter moment arm substantially decreases the total bending moment on the pole, and increases the potential capacity of transformer installations on the pole and crossarms.



THE PAD-MOUNT AND TRANSCLOSURE

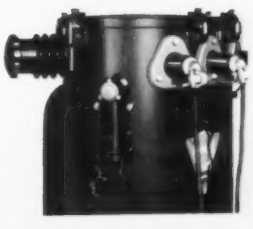
These units provide a convenient means of obtaining attractive, readily accessible transformer installations on underground distribution systems. Bridging the gap between overhead and subway installations, they are applicable for residential, commercial and industrial areas. The Pad-Mount (left) is a specially designed transformer with locked primary and secondary compartments. The Transclosure (right) is a versatile multisize ventilated steel housing for pole-type Round-Wound transformers, and all associated protective, control, and metering equipment.

SRT (SELF-REGULATING TRANSFORMER)

The world's only Self-Regulating Distribution Transformer. It is a Round-Wound transformer with taps, and a hydraulic or electronic regulating mechanism sensitive to secondary voltage. The SRT switches primary taps to provide the desired transformation ratio. A significant departure in the field of voltage regulation, it corrects the voltage at the point of use.

TRANSFORMER THERMAL OVERLOAD INDICATOR

An externally mounted transformer overload indicator. Requiring no internal connection, it provides visible indication of overloads on transformers up to 100 kva by means of a drop-down indicator. Actuated by tank wall temperature, the device can be mounted on a bracket provided on all L-M transformers; or through the use of a permanent Alnico magnet mounting can be attached to any make of transformer. Ambient temperature-compensated, it is available with or without indicator light.



Valuable Gifts To Celebrate L-M's Transformer *Silver* Anniversary!

For utility employees

BEAUTIFUL TOASTMASTER APPLIANCES (choice of toaster, fry pan or coffeemaker)—awarded to 200 of the utility employees hired in 1934 and still employed.

Rules for Employee Gifts

All personnel hired by an electric utility during the calendar year of 1934 who will complete 25 years of employment within the calendar year of 1959 are eligible. Only employees of electric utility companies that generate, transmit or distribute electric power for sale, located within the 50 United States, are eligible. Each entrant must submit a complete entry form to Line Material Industries, Anniversary Awards, Milwaukee 1, Wisconsin. *Only one entry form per eligible person.* Entry form must contain all requested information, including choice of gift, and must be signed by your personnel manager or an officer of your company. Entry forms must be postmarked not later than midnight December 15, 1959. All valid entry forms will be gathered and a drawing will be made in the presence of an impartial utility company executive. The first 200 names selected will receive their indicated choice of Toastmaster gifts. Drawings will be made during Christmas Week. Announcement of winners will be made during January, 1960. All awards subject to federal, state and local regulations. Use the form below or get additional entry forms from L-M Field Engineers, from Line Material offices, or in the Line Material Magazine, The Line.

Lucky Day Bonus

If your name is selected as a recipient of a Toastmaster appliance and you were hired on the same date that L-M started manufacturing transformers, you will also receive an extra *cash bonus*. Announcement of Lucky Day and Lucky Day Bonus winners will be made during January 1960.

For utilities

$500 CASH (for employees benefit program) PLUS a new 50 kva Round-Wound transformer —awarded to the utility that turns in the oldest operating L-M transformer.

Rules for Old Transformer Award

All electric utility companies that generate, transmit or distribute electric power for sale, located within the 50 United States, are eligible. Utility must submit in writing on company letterhead the serial number, hv, lv, kva, location and known history of the oldest transformer bearing a L-M nameplate. This old L-M transformer must not have been rebuilt or uprated. It must contain the original core and coil. The utility that turns in the oldest L-M transformer (serial no. nearest 50,000) will be awarded a choice of either a conventional, RWP or Pad-Mount transformer, in any rating 50 kva or below, 15 kv or below, plus $500.00 for an employee benefit program (scholarship, athletic, lounge, etc., at the discretion of utility management). The winning transformer will become the property of Line Material Industries. All entries must be submitted to Line Material Industries, Old Transformer Award, Milwaukee 1, Wisconsin, postmarked not later than midnight December 15, 1959. Announcement of winner will be made during January 1960. All awards subject to federal, state and local regulations.

LINE MATERIAL Transformer Silver Anniversary Service Award
OFFICIAL ENTRY FORM (please print)

Employee's Name_____

Home Address_____

City & State_____ Zone_____

Job Title_____

Date of Employment_____ Day_____ Month_____ Year

Company's Name_____

Address_____

City & State_____ Zone_____

The date must be certified by your personnel manager or an officer of your company

I hereby certify that the above person was employed on the date shown.

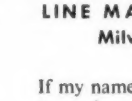
_____

Signature Title

LINE MATERIAL INDUSTRIES
Milwaukee 1, Wisconsin

If my name is selected I would like you to send me (circle one only):

A Toastmaster Automatic Toaster, Model #1B24, Retail Value $21.00.



A Toastmaster Automatic Fry Pan with Lid, Model #8D1, Retail Value $26.45.

A Toastmaster Coffeemaker, Model #5D1, Retail Value $29.95.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY

McGRAW-EDISON

This is L-M's Transformer Silver Anniversary

THIS LINE MATERIAL SRT TRANSFORMER allows Puget Power to supply 120/240 volts, single-phase power to the remote SAGE installation high in the Cascade Mountains. The output voltage of this SRT transformer is 120 volts plus or minus 1¾ volts.

Puget Power Serves Remote SAGE Installation with L-M SRT®

An important link in our national defense is supplied regulated power by L-M Self-Regulating Transformer more economically and satisfactorily.

This Pacific Telephone and Telegraph Company-operated SAGE installation is among the many customers served by Puget Sound Power & Light Company. Located high in the Cascade Mountains of Washington, SAGE (Semi-Automatic Ground Environment) is a vital link in our national defense network. Its computer receives warnings of impending danger from advance radar networks and relays them to command headquarters. Human intelligence must determine whether an actual attack is being made and must command SAGE into action. If our nation is in danger, SAGE automatically directs the most strategic planes or missiles to intercept and destroy the attackers.

Puget Power determined that power would be delivered more economically and satisfactorily to this remote location by the use of a single-phase 2400-volt multi-grounded neutral, unshielded aerial cable.

Since one of the primary considerations was the desire to use 2400-volt unshielded cable and to eliminate the possibility of line regulation affecting this important load, SRT was considered to be ideal for this application.

This SRT has been in service through the past winter and summer, delivering 120/240 volt, single phase service. The load is sufficient to require a 25 kva SRT transformer. The Adapt-a-Tap was set for maximum boost and the voltage output maintained at 120 volts plus or minus 1¾ volts.

Get Complete Information

For complete information on the SRT transformer and how it can provide regulated voltage at any remote location, contact your L-M Field Engineer; or write Line Material Industries, Milwaukee 1, Wisconsin.

Regardless how distant your load may be from the distribution substation, the SRT provides regulated voltage.

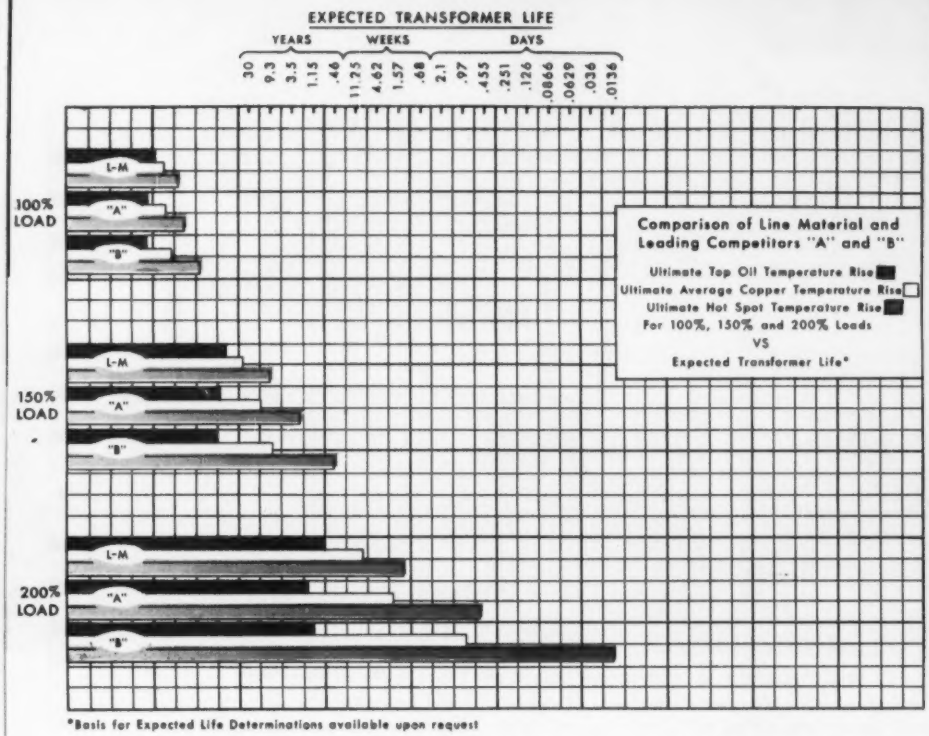
424

LINE MATERIAL® Industries *Distribution Transformers*

McGRAW-EDISON COMPANY

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

McGRAW EDISON



*Basis for Expected Life Determinations available upon request

BASED ON AIEE TRANSACTION PAPER, "Life Expectancy of Oil Immersed Insulation Structures," volume 72, pages 924-29, and laboratory tests, transformer life can be estimated by comparing bar length with scale at top. (Note: the longer the bar, the shorter the life.)

L-M Increases Secondary Breaker Setting

Low winding and insulation temperatures permit uprating L-M transformers without any sacrifice of transformer life expectancy.

by **A. R. WAEHNER**
Director
Transformer Product Sales
Line Material Industries

During the past year, much has been claimed about improved transformer insulating materials and systems. This has led to confusion and justified concern on the part of many users who are interested in the long life of distribution transformers.

The anticipated life of a transformer is not governed *solely* by the insulating materials used therein—but, just as importantly, by the temperatures at which they operate. The *design* of the core and coil structure that permits the *most rapid removal* of the heat generated within the winding results in the lowest insulation temperature.

Rapid extraction of heat from the vulnerable areas of the coil reduces the internal copper temperature that causes insulation deterioration, thereby extending life expectancy.

High Top Oil Temperature

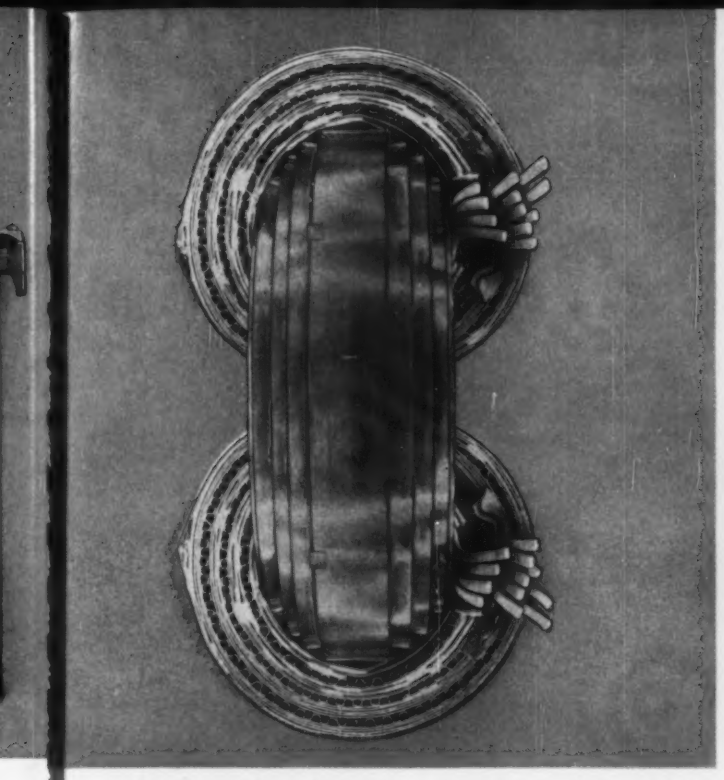
The inherent characteristics of the Line Material Round-Wound® design create *higher* top oil temperatures and lower copper temperatures than in other designs with the same total losses. This is an *advantage* and not a *disadvantage*, as it proves the rapid removal of internally generated heat. Just as hot beverages placed in a thermos jug cool slowly, in like manner other designs of cores and coils restrict the release of generated heat to a greater degree than in the Round-Wound design. Because we transfer heat to the oil more rapidly, the Round-Wound hot spot temperature is reduced, overload capacity is increased, insulation is not jeopardized, and life expectancy is extended.

Another advantage of higher top oil temperature is the more rapid dissipation of transformer heat because of the *higher* gradient between tank wall and ambient temperature of the surrounding atmosphere.

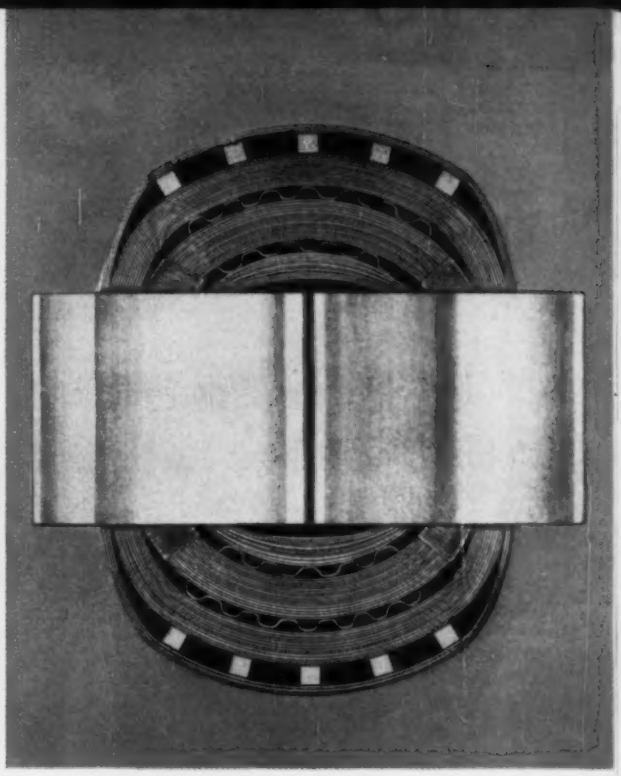
The illustrations on these pages clearly reveal a vastly greater percentage area of coil exposure to cooling oil than in competitive designs. Note, also, the many strategically located cooling ducts.

Low Temperature Gradient

Fast heat transfer in a Round-Wound core and coil rapidly raises top oil temperature *closer* to the hot spot temperature. The degrees difference is known as "temperature gradient" and is lower in the Round-Wound design than in any other make of core or shell type transformer available today. Low temperature gradient is a most significant factor contributing to long transformer life,



THIS END VIEW shows how L-M's exclusive Round-Wound design permits more oil ducts and exposes maximum cooling surface area. Winding heat is transferred more effectively than by other designs.



THIS END VIEW shows how shell type window dimensions prohibit oil ducts on the inside where heat build-ups occur. Only L-M's Round-Wound design provides concentric cooling.

on Round-Wound-Protected Transformers

especially at times of heavy overload when transformers are most vulnerable to high insulation temperatures. To take the ideal condition, if the gradient were zero degrees, heat would transfer instantly, top oil temperature would be higher, hot spot temperature would be lower, and the ultimate in life expectancy would be attained.

Laboratory tests of modern competitive samples compared with the Round-Wound design prove conclusively that at periods of heavy overload, the Round-Wound hot spot temperature is lower than with any other modern competitive design. In fact, it is *less* than the average copper temperature of at least one leading make of transformer. This is dramatically revealed in C. R. Acker's technical article in the September-October, 1959 issue of THE LINE Magazine.

Continuing Research

As a pioneer in long insulation life, Line Material, in 1951, was the first manufacturer to introduce oxidation resistant transformer oil (ORTO®). Our research and design engineers, with the assistance of Thomas A. Edison Laboratories, maintain a continuing search for improved insulation systems. If and when we find a better system, we will adopt it. The insulation system employed in the Round-Wound design, since its inception, is the finest available. The Round-Wound transformer you buy today will provide equal or greater life, under any comparable loading conditions, than any other transformer available in the industry today, *without* the necessity of a design change.

Higher Secondary Breaker Settings

Throughout the years, our Round-Wound units have enjoyed liberal overload capacity with breaker settings in line with those dictated by the current usage in the industry. Our RWP® breaker settings have been recalibrated to be as high as or higher than those offered by any other major manufacturer today. Transformers with this new breaker calibration will be identified with this symbol ‡ following the Kva designation.

The same confidence in the longevity of Round-Wound conventional transformers may be expected because the core-and-coil designs are identical.

Get Complete Information

Ask your L-M Field Engineer for the complete story on why the RWP transformer can have increased secondary breaker settings without a new design or without new insulation. Or write me at Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries *Transformers*

McGRAW-EDISON COMPANY

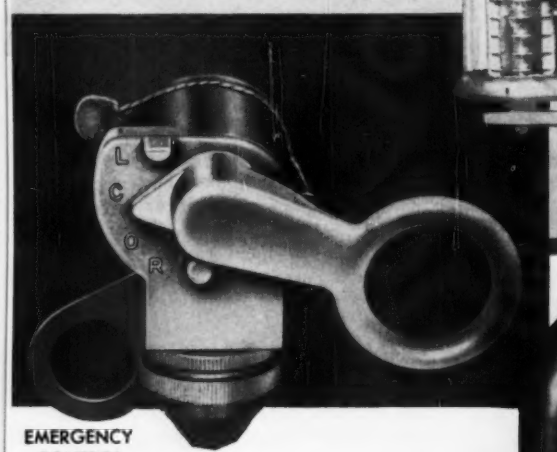
DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

422

This is L-M's Transformer
Silver Anniversary

THIS NEW BREAKER is internally mounted on the core and coil frame, providing easy accessibility through the handhole.

THE NEW L-M SECONDARY BREAKER, with trip-free control handle and signal light in a single unit, is completely operable with hook stick.



EMERGENCY CONTROL

FOUR POSITIONS ARE PROVIDED ON THE CONTROL HANDLE:

Position L—Light reset and/or test. This resets the light mechanism and simultaneously tests the bulb. Handle returns to Position "C" when the hook stick is removed. Thus the bulb and entire light circuit can be tested without risk of inadvertently opening the breaker and disconnecting the load.

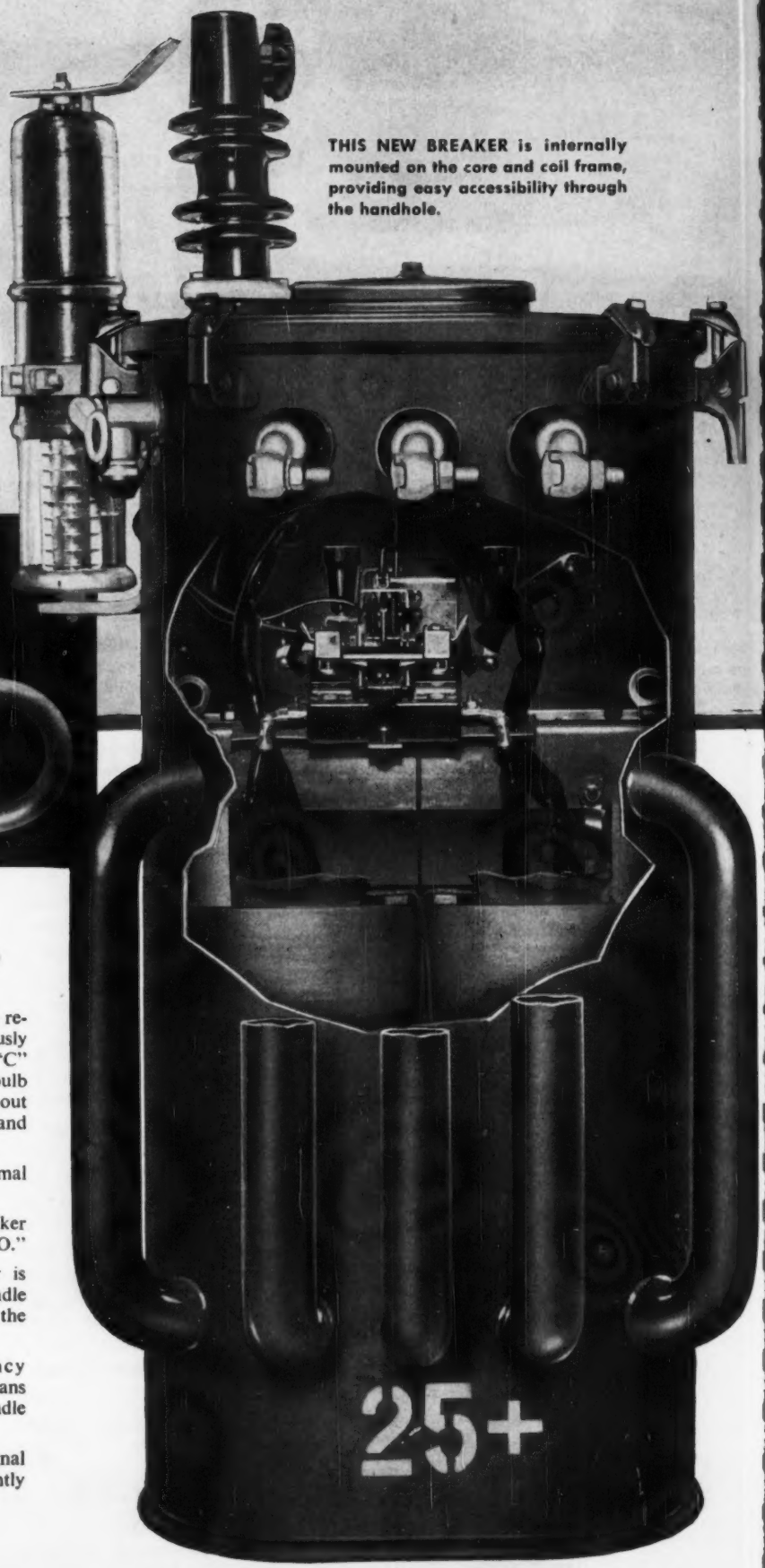
Position C—Close breaker. This is the normal operating position.

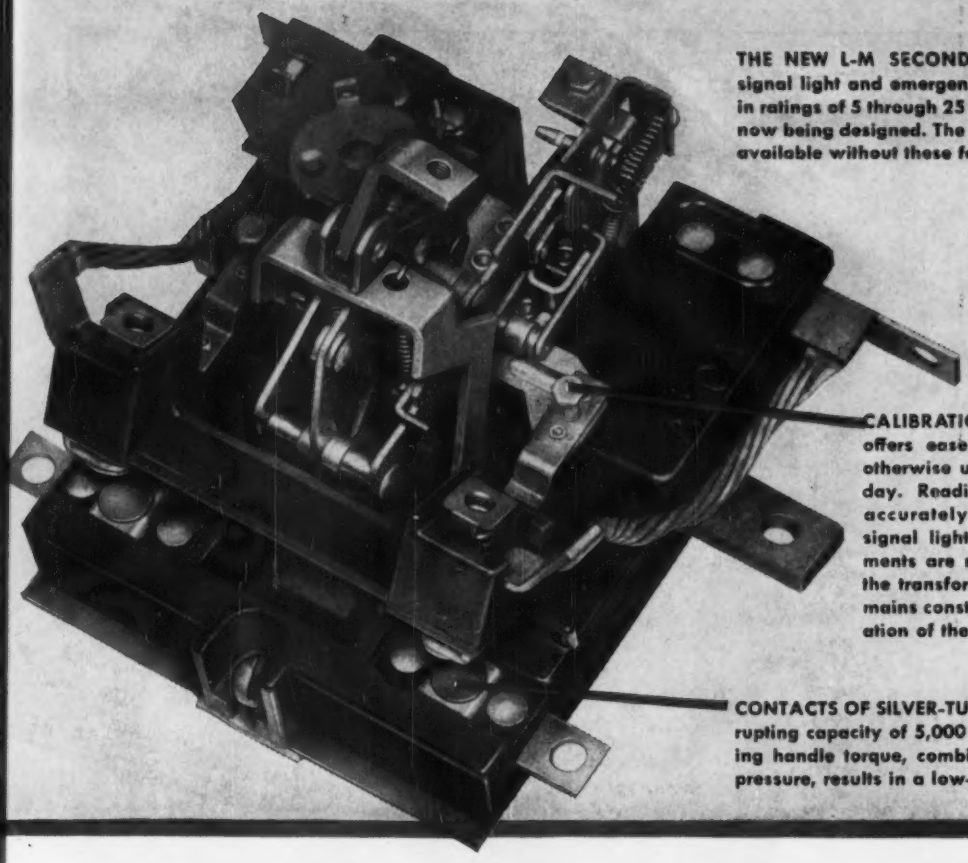
Position O—Open breaker. To open breaker manually, move the handle to Position "O."

Position R—Reset breaker. The breaker is manually reset by moving the control handle to Position "R." This motion precedes the closing operation to Position "C."

Emergency Control Handle—Emergency overload control can be accomplished by means of the emergency control handle. This handle is also hook-stick operated.

Signal Light—The brilliant glass-prism signal light is visible from the ground to slightly above horizontal.





THE NEW L-M SECONDARY BREAKER, with signal light and emergency control, is available in ratings of 5 through 25 kva, with larger ratings now being designed. The 3 and 5 kva ratings are available without these features.

CALIBRATION—This secondary breaker offers ease and accuracy of calibration otherwise unobtainable on the market today. Readily accessible adjusting screws accurately calibrate the overload and signal light settings. The bi-metallic elements are not mechanically connected to the transformer leads; thus calibration remains constant and is not affected by operation of the breaker.

CONTACTS OF SILVER-TUNGSTEN have an interrupting capacity of 5,000 amperes. Low operating handle torque, combined with high contact pressure, results in a low-resistance circuit.

New L-M Breaker Provides Complete Coordination for RWP® Transformers

New Kyle-designed breaker provides operating advantages for L-M Round-Wound-Protected Transformers

By **A. R. WAEHNER,**
Director Transformer Sales,
Line Material Industries

All RWP transformer components are now of L-M design and manufacture, affording a Round-Wound-Protected transformer coordinated for optimum performance. The L-M Type T-3 heavy-duty lightning arrester protects the primary winding against lightning.

Fuse links in the primary leads protect the system by removing the transformer from service in the event of internal transformer winding faults.

Round-Wound® design provides L-M exclusive continuous cruciform wound core with round coils of high impulse and short circuit strength.

Drawing upon Kyle's vast experience in arc-interrupting devices, L-M now provides a secondary breaker that supplements the other L-M manufactured RWP transformer components. With this new breaker, Line Material provides a self-protected transformer that is completely coordinated for optimum performance.

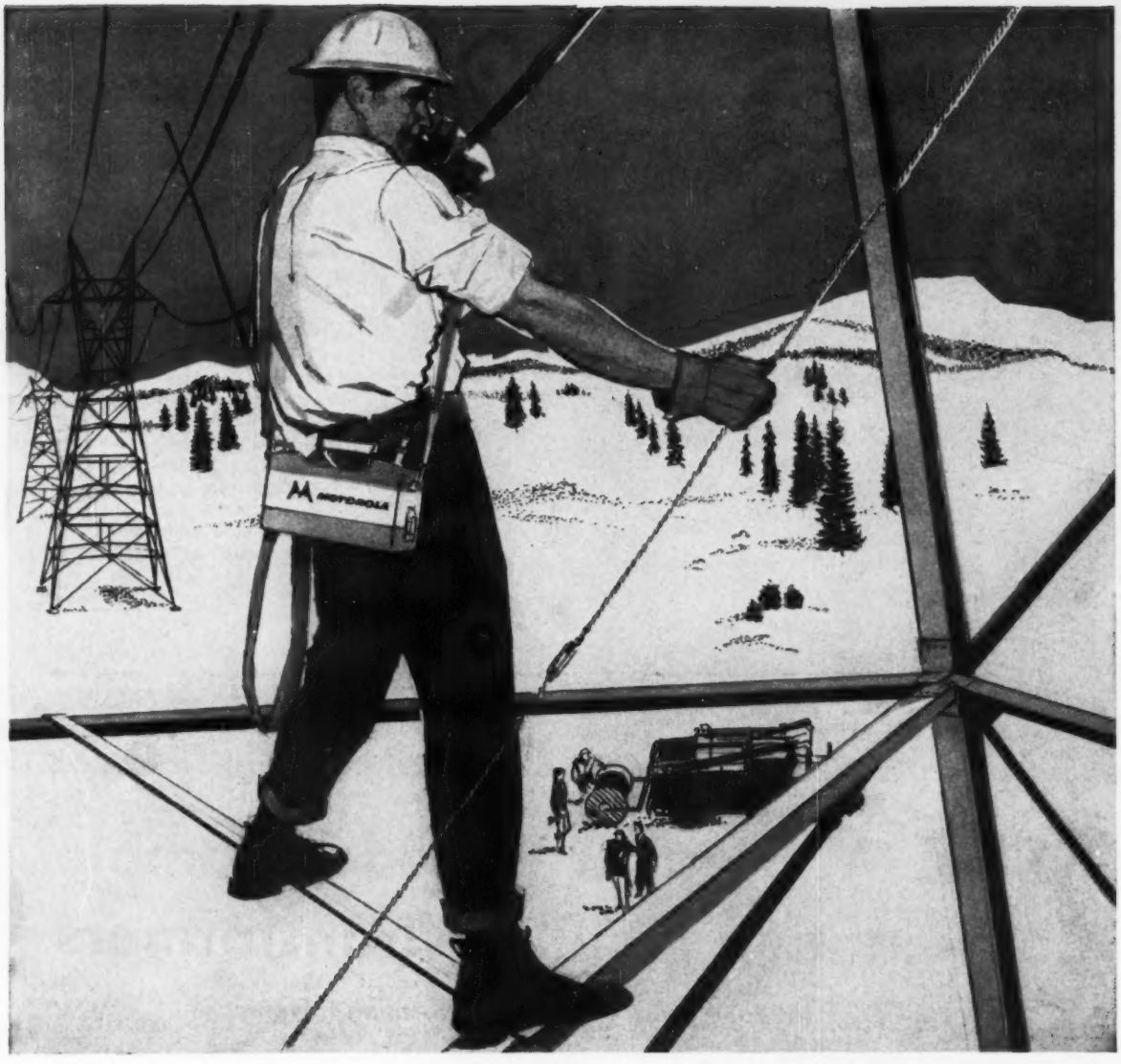
For additional information, contact your local L-M Field Engineer—or write me at Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL® Industries
McGRAW-EDISON COMPANY
Distribution Transformers

McGRAW EDISON

401R

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



"Almost every day we find <u>new</u> jobs for 2-way radio"

SAYS HARRY M. LEWIS, SUPT. OF COMMUNICATIONS, CALIFORNIA OREGON POWER COMPANY

Over canyons, streams and mountains, as well as in heavily populated urban areas, Motorola 2-way radio is helping The California Oregon Power Company construct and maintain electric service *faster, more efficiently* and at *less cost.*

The giant radio network of 16 base stations, 90 mobile sets, and 31 HANDIE-TALKIE® portable radiophones is used by practically every outside working team.

Superintendents and other key men are freed from their desks—can be reached on the job or in their cars. Survey parties and wire stringing crews use HANDIE-TALKIE portables to communicate, spanning long reaches faster and better—saving *hundreds* of dollars every day. Repair crews are more productive—get lines back in operation faster, keeping customers better satisfied. Line patrols in tractors and helicopters work safer and more efficiently with radio.

Whatever the job—Motorola 2-way radio can help you speed it at less cost. Specify Motorola for the most dependable, uninterrupted mobile communications. For a Motorola communications specialist on Power Utility problems—write, wire, or telephone.

MOTOROLA *2-WAY RADIO*

MOTOROLA COMMUNICATIONS & ELECTRONICS, INC. • A Subsidiary of Motorola, Inc. • 4501 Augusta Blvd. • Chicago 51, Illinois

DEAD END WITH

BLACKBURN

W6-2A from 6 Sol to 2 ACSR
This Clamp Will Handle All
Popular Service Drop Wires

WEDGE CLAMPS

For Light Service
W6-4A
6 Sol to 4 ACSR

For Heavy Service
W2-OA
2 Sol to 1/0 ACSR

Conductor in contact with wedge for entire length of slider.

Removable aluminum slider allows installation without threading through clamp.

Drop wire can be pre-sagged and cut to exact length needed.

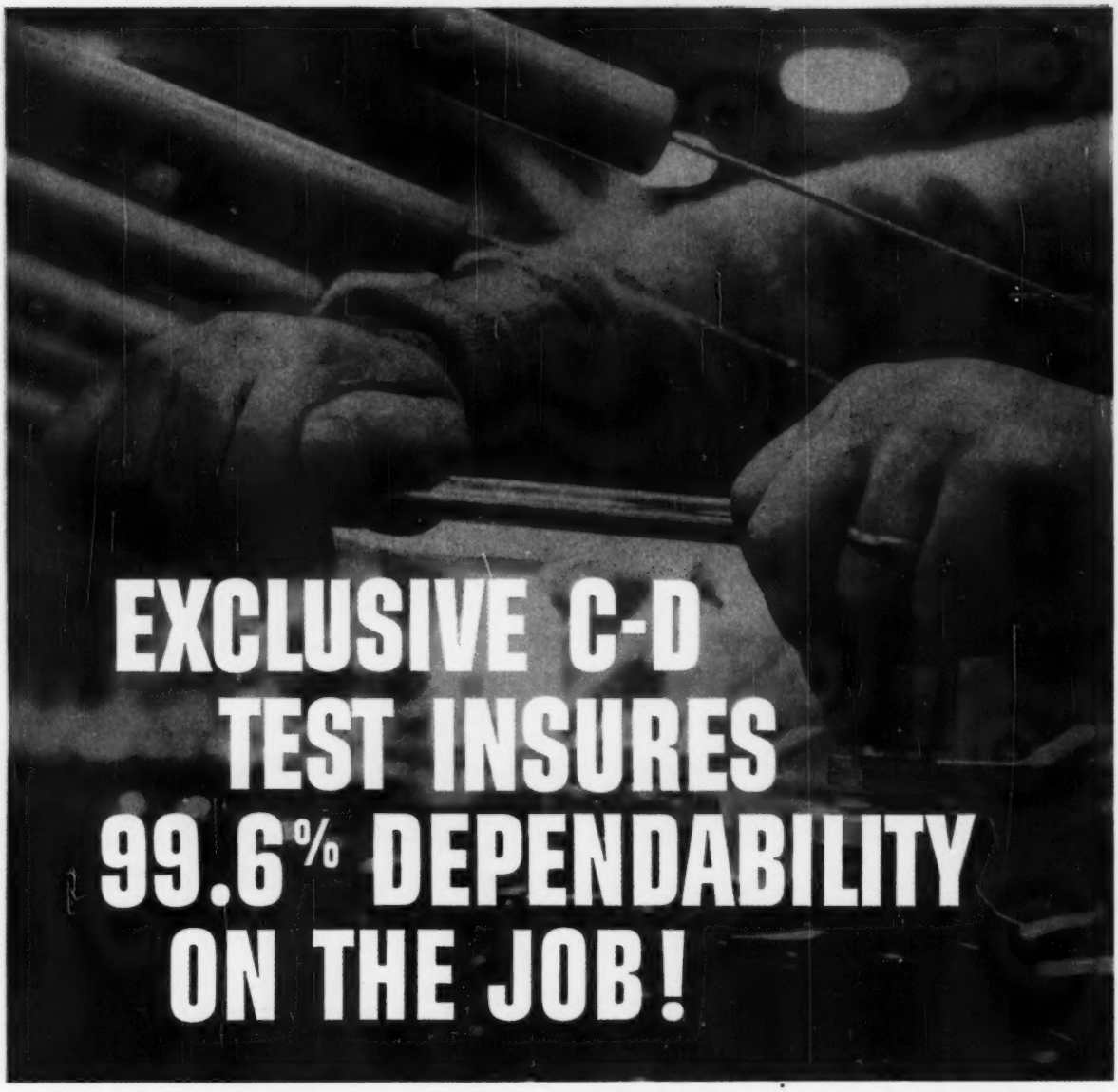
Can be attached to bare neutral at any point in the span.

Your Choice of 3 Bails

STANDARD FLEXIBLE CAPTURED FLEXIBLE FREE

JASPER BLACKBURN CORPORATION

1525 Woodson Rd., St. Louis 14, Mo., WYdown 3-9430.



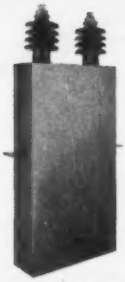
EXCLUSIVE C-D TEST INSURES 99.6% DEPENDABILITY ON THE JOB!

THIS PAIR OF HANDS reaching through a row of fuse links, is checking tightness of electrical connections on a series of C-D shunt capacitors. The hands belong to one of the many skilled C-D inspectors who make sure C-D capacitors are everything you want them to be...reliable, long-lasting and maintenance-free.

Before coming to this particular pair of hands, the capacitors were subjected to capacitance, leak, dielectric and energization tests. The energization test—*exclusive* with C-D—puts the units through an hours-long, full-voltage "heat run" that duplicates the same conditions the capacitors meet in the field. The capacitors aren't shipped unless they pass. That's why C-D capacitors deliver an unbeatable *99.6%-sure performance on the job.*

Invest your purchasing dollar in *internal* quality—the only place it really counts. See a C-D sales engineer today. Write to Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

Consistently Dependable
CORNELL-DUBILIER
POWER-FACTOR CAPACITORS

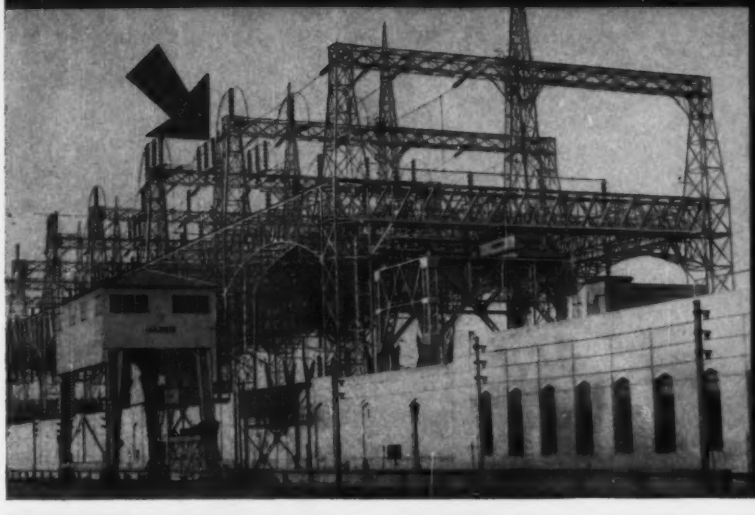


15, 25, 33.3, 50 and 100 KVAR capacitors for every application, with lowest dielectric unit stress, highest major insulation level and power losses considerably below the NEMA limit of 3.33 watts/KVAR.

REVOLUTIONARY NEW PAINT

CUTS MAINTENANCE COSTS

30% AND MORE!



VITA-VAR'S STAINLESS STEEL PAINT

Life Expectancy 12 Years or More!

Smooth Surface Resists Dirt and Soot!

Easy to Apply! Cuts Painting Costs!

Finish Becomes Brighter and Lighter!

Non Corrosive! Contains Stainless Steel Flakes!

VITA-VAR STAINLESS STEEL PAINT #13448 – A product of Vita-Var's Research Laboratory which co-operated with a large power company in the pioneering of its development – represents a significant advance in the durability of maintenance paints for steel and aged galvanized iron exposed to corrosive atmospheres.

THIS PAINT which contains a mixture of stainless steel flake (18% Cr., 8% Ni) and non-metallic pigments has successfully passed 8 years of extensive laboratory and field tests in corrosive areas.

FIELD TESTS on transmission towers recently inspected revealed that the paint showed no failure and retained its original freshness which indicates that it will afford protection for at least 12 years and probably more.

Investigate the superior advantages as compared to quality conventional paints! **LONG LASTING** due to protective qualities of stainless steel flake! **SMOOTH SURFACE** discourages dirt and soot deposits! **EASE OF APPLICATION** by brush, spray or roller coater reduces painting time! **MINIMUM CHALKING! METALLIC** appearance enhanced by aging, color becomes brighter and lighter! **LIFE EXPECTANCY**... 12 years or more!

For further information, write to:

VITA-VAR CORPORATION

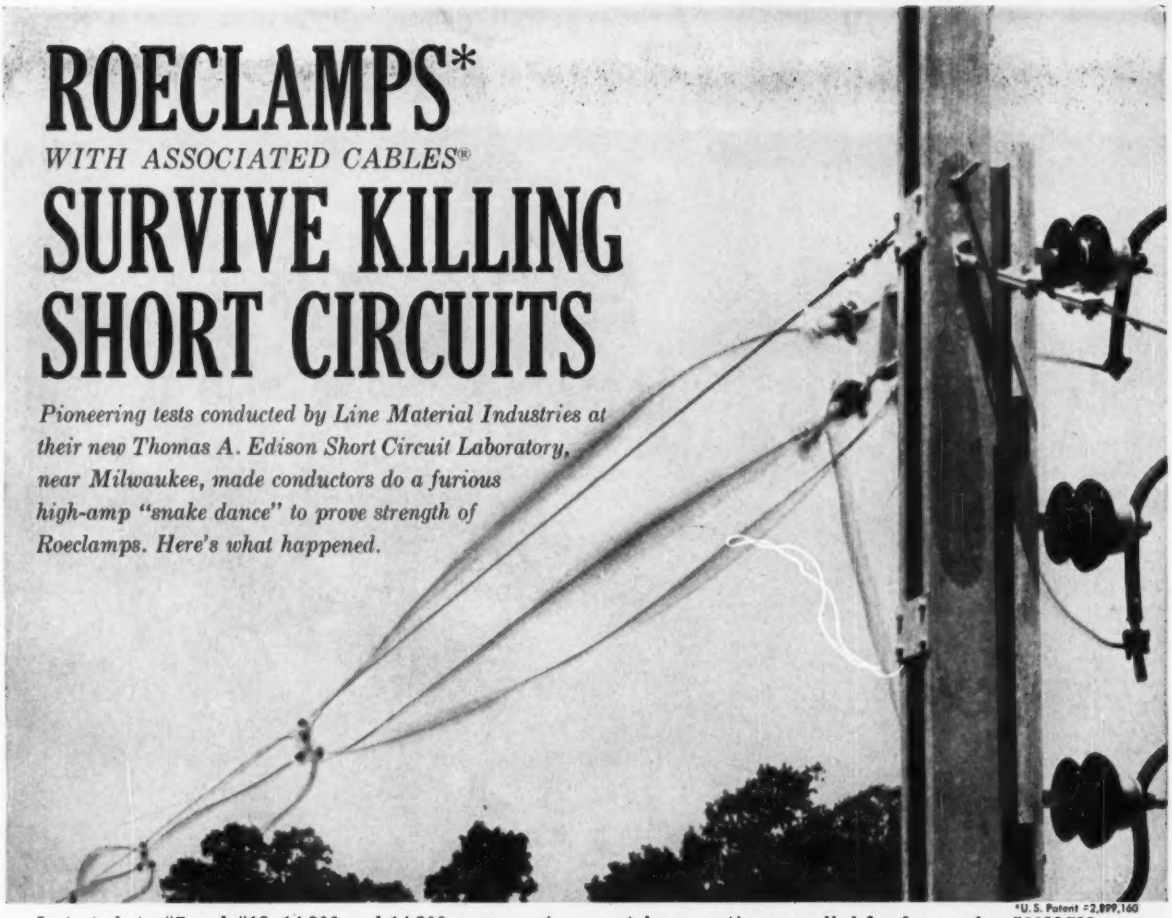
NEWARK 2, N. J. **Paint Engineers Since 1888**

ROECLAMPS*

WITH ASSOCIATED CABLES®

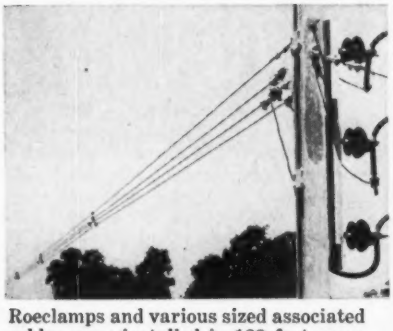
SURVIVE KILLING SHORT CIRCUITS

Pioneering tests conducted by Line Material Industries at their new Thomas A. Edison Short Circuit Laboratory, near Milwaukee, made conductors do a furious high-amp "snake dance" to prove strength of Roeclamps. Here's what happened.

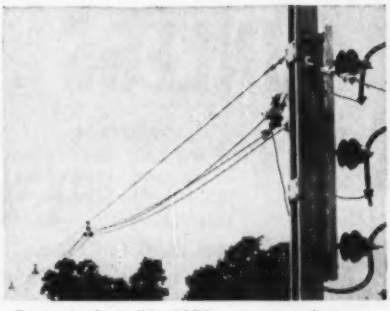


*U. S. Patent #2,899,160

In test shots #7 and #12, 14,300 and 14,200 amperes (asymmetric current) are applied for four cycles. 500MCM conductors are whipped around with incredible force. Strong 5KV and 15KV Roeclamps contain the cables, and withstand this fantastic overload. These were two of over a dozen test shots conducted in the impartial Line Material laboratory.



Roeclamps and various sized associated cables were installed in 128 feet span, shorted at far end and linked with power source and controls inside Line Material Industries' new laboratory. Every 30 feet a Roeclamp holds cables and messenger firmly in place. Roeclamps require no installation tools, can be mounted in less than a minute, even with "boxing gloves" on.



In test shot #2, 3950 amperes (asymmetric current) was applied for 30 cycles to a #6 AWG conductor. This was approximately 100% beyond the rated thermal capacity of the insulation. Note that the 5KV Roeclamps are undamaged. In this test the intense heat (conductor temperature 395°C) elongated the cables but they soon resumed their former profile.

Line Material Industries' short circuit Lab features a closed circuit TV Monitor panel to observe testing. It has the most modern metering equipment, and the world's highest speed, 60-cycle generator for short circuit testing. This can deliver over 500,000 KVA of electrical energy momentarily. A 1,500,000 KVA air blast breaker can interrupt 80,000 amperes after any pre-set current flow.

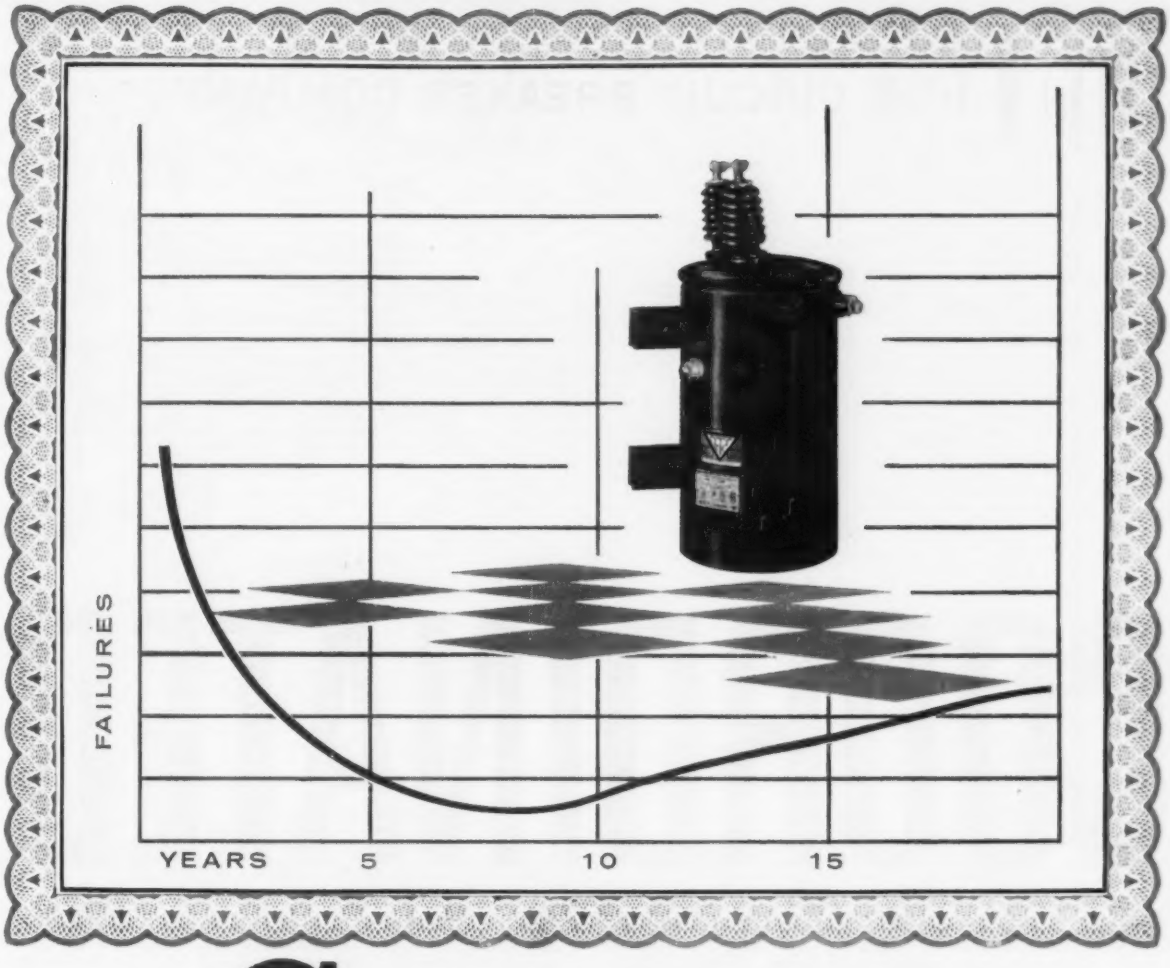
NOW ON FILM

SEE THESE STARTLING TESTS OF ROECLAMPS WITH ASSOCIATED CABLES FOR YOURSELF

A 16mm color movie, showing the complete series of tests is now ready for showing to technical groups. For details write to Line Material Industries, McGraw-Edison Company, 700 W. Michigan Street, Milwaukee 3, Wis., or to Roebling's Electrical Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation



GUARANTEED

for 5 years — further proof of the exceptional quality built into every RT&E Transformer to save you money. The wisdom of this guarantee is borne out by the graph above. This typical mortality curve was developed from actual failure rates of one leading utility and covers all makes of transformers. It shows clearly that most transformer failures due to workmanship and materials occur during the first 5 years of use, the critical period covered by the RT&E guarantee.

In addition to this 5 year guarantee against defective materials and workmanship, RT&E also guarantees all fully protected transformers unconditionally for one full year.

RT&E CORPORATION

WAUKESHA, WISCONSIN
PORTLAND, OREGON

EE

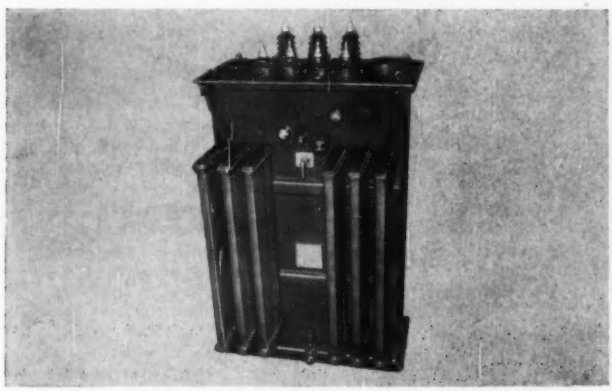
I-T-E CIRCUIT BREAKER COMPANY

COORDINATED

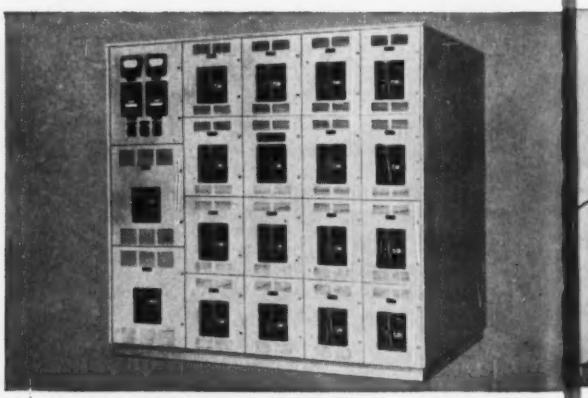
Only I-T-E designs and builds complete primary unit substations in one plant. And because engineers can work so closely together, you benefit from extra time-and-money saving features: better-coordinated designs, easier assembly, pretested performance, and delivery to match your own construction schedule.

At no extra cost to you, I-T-E can custom design and build substations to meet your own particular requirements. In every case you get the additional advantages of I-T-E switchgear . . . sturdier, safer and easier to operate. And I-T-E high-stress transformers incorporate extra protection from fault damage. I-T-E substations are available in all kva ratings and secondary voltages up to 13.8 kv., for indoor or outdoor installation.

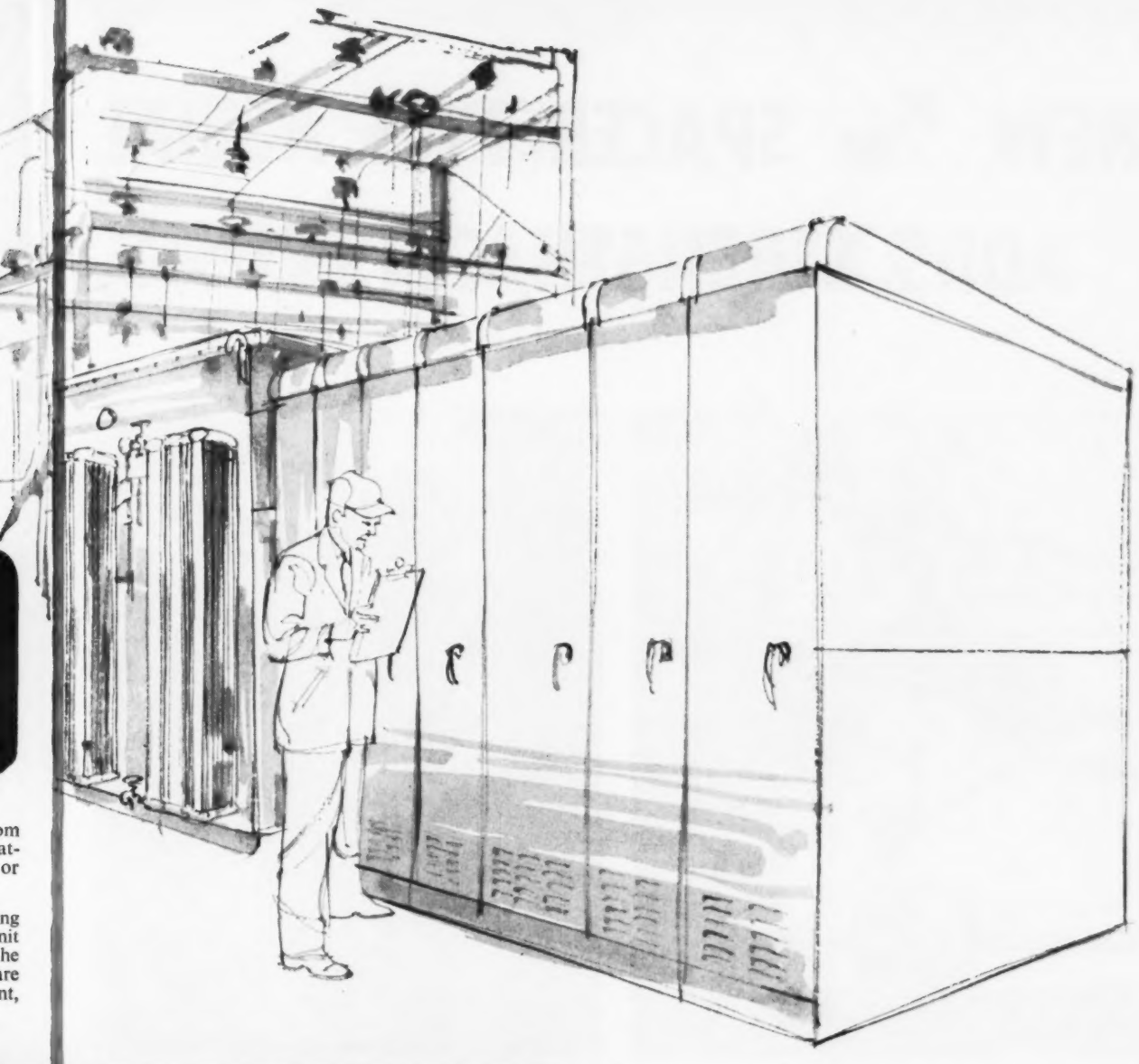
Today more and more electric utility companies are looking to I-T-E as their single source of supply for complete unit substations. For in I-T-E substations, too, they find the advanced design and quality construction to which they are accustomed in I-T-E electrical equipment. Equally important, I-T-E costs no more.

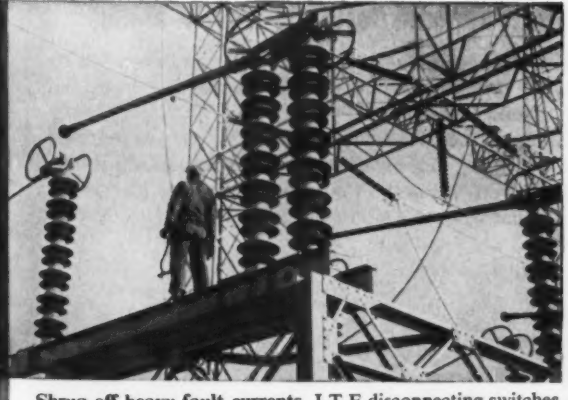


New designs, stronger construction. I-T-E substation transformers incorporate today's most advanced design ideas . . . to give more dependable performance. Ratings up to 3333 kva in single-phase and 10,000 kva 3-phase. Voltages to 69 kv. Liquid-immersed types self-cooled or self-cooled, forced air.



Manual quick-make means greater safety, extended contact life for I-T-E K-Line low-voltage switchgear. Expanded overcurrent trip provides maximum load flexibility. For added safety and convenience, K-Line circuit breakers can be moved to the test position or be disconnected with door closed.





Shrug off heavy fault currents. I-T-E disconnecting switches use heavy silver-to-copper jaw contacts with high thermal capacities to withstand heavy fault currents. Operate easily under severe icing. Available in vertical or horizontal break or tilting insulator configurations.

I-T-E Circuit Breaker Company U-1
1900 Hamilton St., Philadelphia 30, Pa.

Send me detailed information on the following:

- ☐ Primary unit substations
- ☐ Unit substation transformers
- ☐ K-LINE LV switchgear (600 v)
- ☐ Outdoor air switches
- ☐ Load interrupter switches
- ☐ Outdoor substation structures
- ☐ Reclosers
- ☐ Distribution cutouts
- ☐ Other_____

Name_____ Title_____

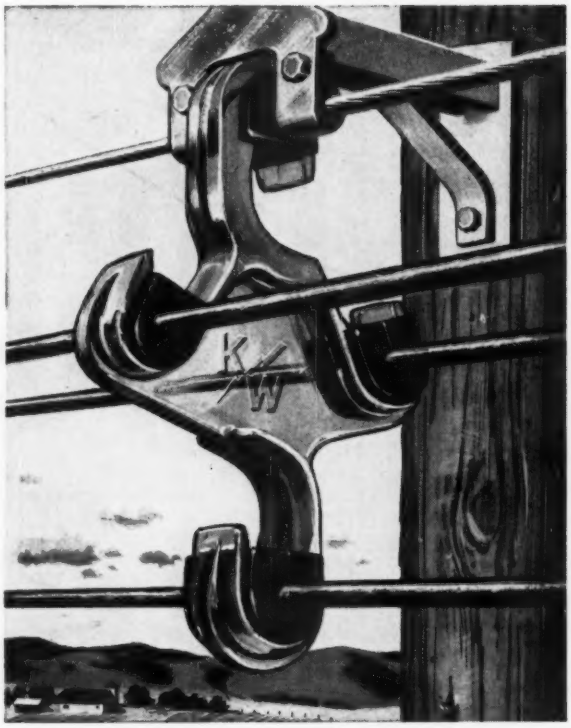
Company_____

Address_____

City_____ Zone_____ State_____

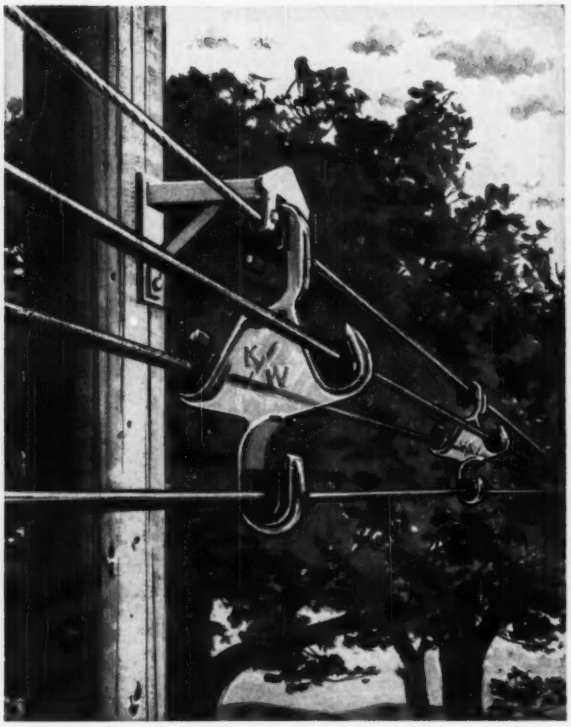
SEND COUPON Get full particulars on specific I-T-E equipment. And remember I-T-E engineering assistance is at your disposal.

NEW K/W SPACER TYPE AERIAL ADDS STRENGTH, CUTS COSTS,



One-Piece Design—Supports 1200 Pounds

New solid spacer design has no loose parts nor movable pieces . . . it's simple, reliable and strong. Can support a minimum distributed load of 1200 pounds. Easy to install, since only one conductor is handled at a time. Snap-in grommets shaped to ease installation. Can be used with or without crossarms; standard hardware available from many suppliers.

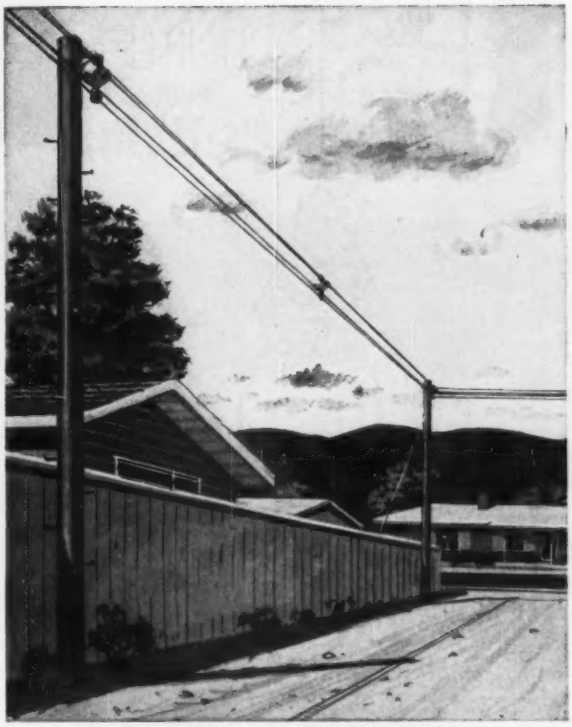


Cuts Material Costs and Tree Trimming

A KW Spacer Cable system can be installed for as little as one half the cost of standard pre-assembled aerial cable!

Compared to open-wire weatherproof, the reduced tree trimming and improved system dependability resulting from messenger supported cables can justify the spacer system's slight additional cost.

CABLE SYSTEM IMPROVES APPEARANCE



Reduced Spacing Improves Appearance

Compared to open wire, closely spaced conductors present a neat, compact arrangement that improves appearance wherever it is installed. Close 6-inch spacing also improves system electrical characteristics . . . permits easy phase identification and proper load balancing. Usual installation practice is approximately 35 spacers per 1000 feet.

WITH its unique new spacer design, KW now offers you unsurpassed dependability and handling ease for cable systems operating at 5 to 15 kv, by using only one spacer for the whole range of voltages.

No tools or tightening necessary: entire spacer system snaps in and locks.

The system consists of four parts: (1) Phase conductors (EC grade aluminum, minimum conductivity 62 per cent, insulated with Polyethylene or Butyl rubber with Neoprene jacket); (2) Special high-strength messenger; (3) Molded one-piece spacers; (4) Molded Neoprene cable-retaining grommets.

Standard hardware is available from leading suppliers. Call your Kaiser Aluminum sales office or KW distributor for immediate service and full information.

Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California.

KAISER ALUMINUM

"IF IT CARRIES CURRENT, KW CARRIES IT!"

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

ALLIS-CHALMERS modern line for '59

Smaller, lighter three-phase transformers

CUT CHANGEOUT COSTS

Greater Capacity on Existing Poles

You save money when load demands require capacity boosting by using Allis-Chalmers three-phase transformers. In most cases, your present poles are more than adequate when you change out with this new smaller, lighter three-phase transformer. In the Allis-Chalmers redesign program spanning all sizes, weight reductions average 25% — height 13 inches. Typical is the new 150-kva unit that actually weighs *300 pounds less* than an old 112½-kva transformer. Reduced weight and size result in improved handling convenience and save hours of installation time.

Operating economies, too

Curvacore design shrinks transformer size and cuts system operating costs. The effective use of preferred oriented steel results in a compact core with low losses . . . low exciting current. Get the complete story. See your A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-1033-E

Curvacore is an Allis-Chalmers trademark.

Editorial Comment

OCTOBER 26, 1959

Death of a Policy . . . or Just of a Word?

"Partnership" is dead. But we're not quite sure whether to write the obituary of the policy, or merely to sound the knell for the word.

Early in President Eisenhower's first term, the Administration projected a policy which would permit local utilities—private or public—to build and operate the power facilities at federal multi-purpose dams. This policy was named, simply, "partnership."

But "partnership" never quite got off the ground, at least on the federal-local level. It had only one real test, and was just recently pigeon-holed.

When Congress authorized northern California's Trinity River diversion project, it permitted the Bureau of Reclamation to request tenders from any local entity to offer to build and operate the power facilities. Pacific Gas & Electric Co, in whose territory Trinity lies, offered the only proposal. Its plan, after much detailed negotiation, was accepted by the Bureau and recommended to the Democratic Congress by the Secretary of the Interior.

Having affixed his stamp of approval, however, the Secretary offered little active support. And the Congress, in partisan mood, declined to approve the recommended contracts. Just recently, it appropriated federal monies for Bureau construction of the Trinity River power works. The Administration has now indicated it will go ahead with federal construction.

Considering the weak support offered the only test case of its policy, we surmise that the Administration has written off "partnership" as a bad political move.

But now we read a report just issued—almost simultaneously with Trinity-partnership's dying gasps—by the Republican Party Committee on Program and Progress. This advisory body is charged with drawing GOP policy, presumably for the consideration of the next national convention.

The committee's report makes a strong plea for "a working relationship between federal and state governments, publicly-owned local utilities, and publicly-regulated private utilities." It would restrict federal efforts to multi-purpose hydro development, and use the "teamwork principle" to let others do the power work. Further, it would have the federal government keep hands off thermal and nuclear power.

Here, in its essence, is the "partnership policy," though under a different name. We are delighted, but we are sorely confused. A Republican Party policy committee, constituted by the President as titular head of the party, plumps strongly for a policy which the present Administration refused to roll up its sleeves and fight for.

"Teamwork" or "partnership," we're for it. But we wish the present Administration, which popularized the idea, would see fit to work actively for it.

Smorgasbord in the Morning?

Who has sampled the traditional *Svenska* smorgasbord, who is not tantalized at the very name?

A recent item implied that an Indiana utility had turned epicurean. It began by saying a smorgasbord was laid out each morning for linemen.

As we read on, the blow fell. The Indiana board groans, not with rare edible delicacies, but with "exempt" hardware. Our vision shifted to a crew circling the table, daintily selecting here a clip, there a cotter pin.

Recovering, we saw the wisdom. Display such items freely, urge all to satisfy their needs. And don't load the menu with paperwork.

Coal Fights to Keep a Rate Cut

- **Testimony at ICC hearing stresses that railroads and coal suppliers' price reductions last spring stemmed from utilities' plans to switch to oil**

- **After hearing from oil industry, ICC will decide if the rates will remain in effect until next March**

The coal industry is trying to keep the market it has left for stoking electric steam plants. The fight is before the Interstate Commerce Commission—and the issue is coal's request for lowered freight rates to haul coal to the East Coast to compete with fuel oils.

The commission is expected to issue a ruling that could have long range effects. The basic issue is whether the ICC, with its power over freight rates, will allow railroads to cut hauling charges enough to keep coal competitive with fuel oil—coupled with a simultaneous reduction in the mine-head costs.

Fuel Switch Study Brings Cut

The issue came to a head last spring when the railroads and coal mines found that a large number of electric power companies in the New York area were considering shifting from coal to fuel oil this season because of oil's lower cost. Most of the companies are equipped to use either fuel and buy on a basis of cost per Btu.

To keep from losing this market, the railroads and coal mines issued a round of price cuts. The railroads made a 50¢-per-ton cut in freight rates on all coal tonnage over 3-million tons delivered between April 1, 1959 and March 31, 1960, on condition that each consignee would receive at least 5.5-million tons of coal during this period. Along with this, coal mines made a 25¢-per-ton cut in the mine cost of coal.

The result is that a ton of coal can be laid down in the New York harbor area for around $9.28 a ton, which is cheap enough to keep utilities from shifting to residual oil.

When the lower rail tariffs were issued last spring, the Empire State Petroleum Assn protested to the ICC and asked for an investigation into the matter. The commission refused to suspend the rates, but did undertake an investigation.

Three days of public hearings were held in Washington starting Oct. 14. They will continue hearings today. A final ruling by the ICC won't come for several weeks, but observers look for the commissioners to rule in favor of the railroads.

Heard from so far have been representatives from the railroads, coal suppliers and such utility companies as Consolidated Edison Co of New York, Long Island Lighting Co, Jersey Central Power & Light Co, Atlantic City Electric Co, Philadelphia Electric Co, Delaware Power & Light Co, Baltimore Gas & Electric Co, Niagara Mohawk Power Corp, Connecticut Light & Power Co, and others in the Eastern Seaboard area.

Utilities Make Points Clear

The utility witnesses have made three points very clear in their appearance before the ICC hearing: That they would have made substantial shifts to fuel oil this season without the cut in coal prices and rail rates; that as far as they know their fuel oil suppliers are not members of Empire State Petroleum Assn; and that the price cuts amount to merely holding on to a market and not tapping a new one.

On the first point, the utilities openly stated that they were approached—separately—by the railroads and the coal suppliers and sounded out as to the prospects for coal use during the current heating season. Following these discussions, the new price cuts and rate reductions were installed.

Typical testimony offered in support of the price cuts came from H. M. Barrett, purchasing agent of Delaware P&L. Barrett told the hearing that his company expected to use some 746,000 tons of fuel this year that could either be coal or fuel oil. With the downward trend of fuel oil prices it most likely would have been fuel oil that would have been used this year, Barrett said.

Before the coal and rail cuts, Barrett said the cost of oil, in coal equivalent, was $9.41 a ton compared with $9.76 a ton for coal. And, Barrett told the ICC hearing examiner, he felt his company could have negotiated oil prices down to around $9.20 a ton. This compares with the delivered price of coal at its reduced rates of around $9.28 a ton.

In view of the lower coal and rail prices, Barrett told the hearing that Delaware P&L decided to stick with coal use this year rather than shift to oil. And, that is pretty much what each of the utilities reported.

Rail Revenue Down

Over all, the railroads say they would have lost from 9 to 10-million tons of coal traffic during the 1959-1960 season if the rate reductions had not been installed. If the reduction had not been made, the rails reported, it would have meant a loss in gross revenue for that period of from $42 million to $44 million. Even with the traffic at the lower rates, the lines still expect to have their revenues chopped by some $5 million. This, however, is better than losing the whole pie, the rails explain.

By making the-50¢-a-ton reduction subject to minimum volumes, the rails are able to hold many utility plants that otherwise would still go to oil. It also blocked any competition from new price cuts in fuel oil. Once the utilities made their agreements for the low rate minimums, competition for this year was pretty much ruled out. The rates expire, however, on March 31, 1960. Then, the matter will be thrown open for new bargaining.

It is this point that makes the forthcoming ICC decision so important, industry sources say. If the ICC sanctions the past coal-rail actions, then each year may bring its own set of tariffs designed to hold the market.

Fuel Needs . . .

. . . pegged to conventional sources, Congressmen told

Conventional fuels are more than adequate for U.S. power generating needs in the near future, while nuclear and solar methods hold promise for more distant years, a Congressional joint economic subcommittee was told recently.

Testimony from energy experts concluded the subcommittee's week-long hearings on the nation's energy needs and resources. Earlier, testimony dealt with U.S. electric development (EW, Oct. 19, p 54).

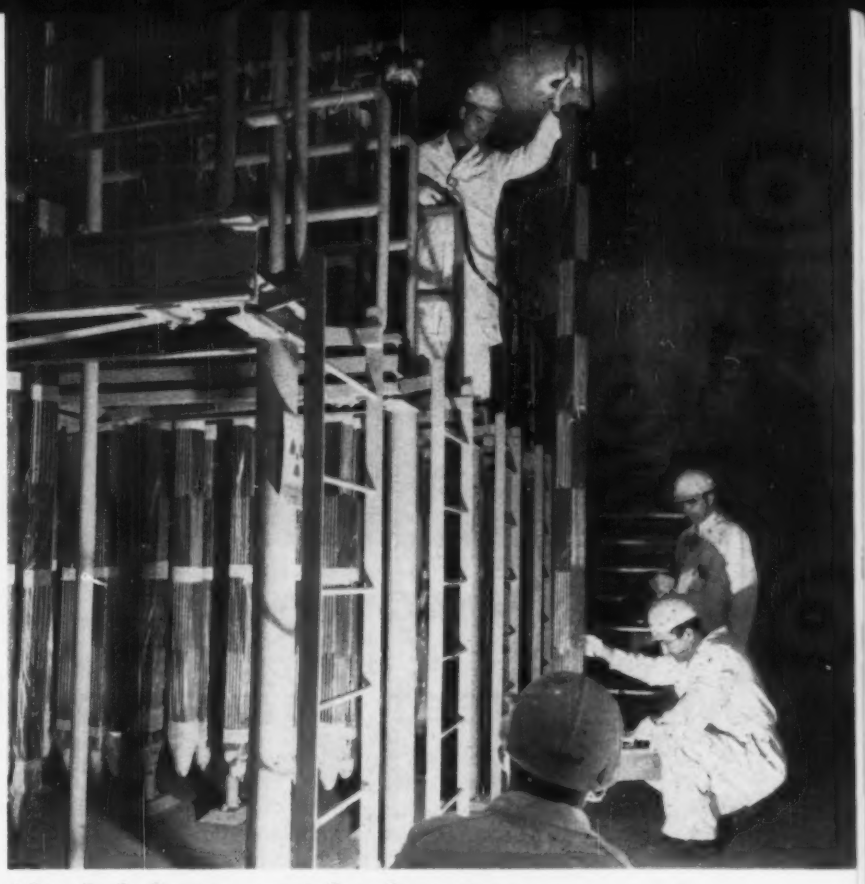
Federal Power Commissioner Arthur Kline predicted natural gas would be in adequate supply for the next decade, although the price would rise in relation to other fuels. Richard Gonzalez, treasurer of the Humble Oil & Refining Co, predicted an "adequate" oil and gas supply.

Joseph A. Moody, president of the National Coal Policy Conference, Inc, pointed out that 68% of the nation's steam-electric generation is fueled by coal today, and predicted that coal will remain dominant until replaced in the long-run by nuclear plants. He urged establishment of a joint Congressional committee on national fuels policy.

Trend to Mine-Mouth Plants

Mine-mouth power plants are becoming more common in the West said Veryl Hoover, Wyoming division manager of Pacific Power & Light Co. He listed several that are either planned or under construction. His company put a 100,000-kw plant on line in December, 1958 at a coal mine near Glenrock, Wyo., and the PP&L is building a second 100,000-kw unit there. The coal is too low-grade (7,000 BTU per lb) to ship, but is adequate for a mine-mouth plant. Hoover pointed out that it can also use light oil, "Bunker C," gas, pitch or coal.

About 20% of the nation's power will be generated by nuclear energy in 1980, predicted Walter H. Zinn, president of General Nuclear Engineering Corp. He said this would call for 250 plants of 200,000-kw capacity each.



After fuel elements are taken from storage . . .

Dresden Achieves Criticality

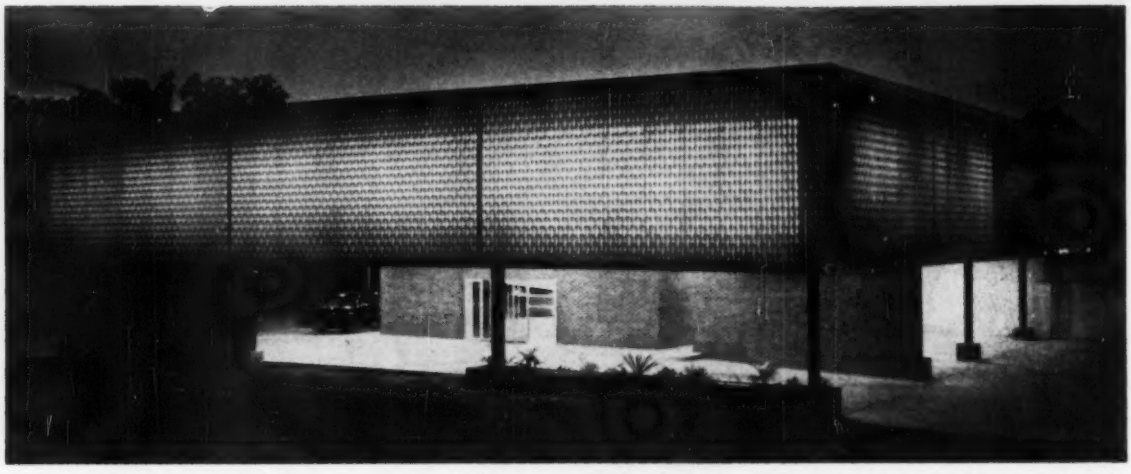
At 2:45 am Oct. 15, the reactor for Dresden nuclear power station sustained its first chain reaction. Criticality was achieved 32 hours after the first fuel element was loaded. The development is the first step in a reactor testing program that will lead to production of electricity early next year.

Criticality was reached after General Electric Co and Commonwealth Edison Co scientists and engineers placed the 28th fuel element in the core of the dual-cycle reactor. Ultimately, 488 fuel elements will be loaded into the reactor. In the illustration above, the 4-in. square by 11-ft long elements are removed from storage. Each contains 36 zirconium alloy fuel rods, which are enclosed in zircaloy jackets. Each rod contains 208 uranium dioxide pellets 0.5 in. long and 0.5 in. in dia.

GE is developing the 180-Mw (net) station for the utility. Cost of the plant is $45 million of which Commonwealth Ed will spend some $36 million, including site and overhead costs. The balance is being paid by Nuclear Power Group, Inc., which is made up of Commonwealth Ed, six other utilities, and the Bechtel Corp—engineer-constructor.

Test runs already have been made with the plant's turbine-generator. Temporary oil-fired boilers were brought to the site near Morris, Ill., for the tests. Dresden is located on a 950-acre tract 50 miles southwest of Chicago at the confluence of the Kankakee and Des Plains rivers.

Dresden is America's first full-scale, privately-financed atomic power plant. After several months of power tests, the station will go into operation in the summer of next year, about six months ahead of the original schedule. Its output will be enough to supply needs of a city with 200,000 people.



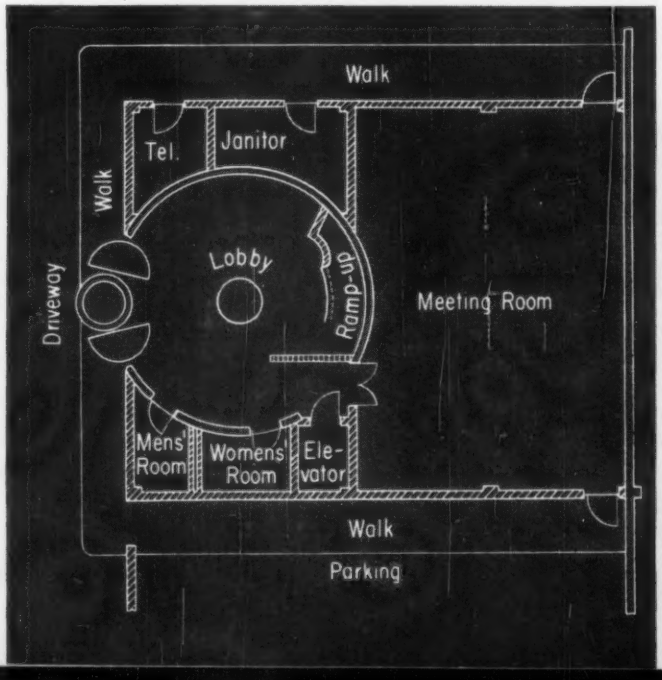
FABRIC PATTERN of CLECO's new executive building is created by solar blocks rimming exterior. The $370,000 split-level structure was designed by Roberts & Barksdale, architects, of Alexandria, La.

Main Street Gets a Touch of Arabia

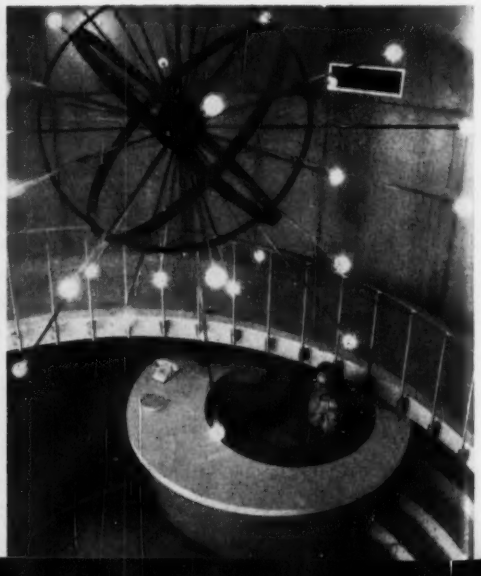
Citizens of Pineville, La., finally got their chance to see the interior of that new building out at 415 Main St. An open house Oct. 12 at Central Louisiana Electric Co, Inc's $370,000, split-level executive building attracted 3,000 of the city's residents, many of them intrigued by an Arabesque fabric pattern created with a 13-ft wall of solar blocks rimming the exterior. From almost any inside point they were able to see outside through the 270 lineal ft of glass exterior.

Constructed on a 2.6-acre tract, the two-story building has 14,000 sq ft of roofed area, 11,000 sq ft of walled-in space, and total floor area of 19,080 ft. It features a circular lobby around which a cantilever walkway ramp winds up to a skylighted patio partially walled in by more solar blocks, and the upstairs offices. A demonstration kitchen and an auditorium are located on the first floor. Equipment includes a 43-ton air conditioning unit. The overhanging second-story perimeter houses the executives' offices and other rooms.

In the postwar period other U. S. utilities have aimed for a consolidation of executive and departmental offices. When asked for reasons about its resistance of the trend, Vice President Paul R. Taylor said CLECO includes properties added through mergers so some offices remain in other communities. It's impractical to move these offices to Pineville now, he said. The distance factor is offset by a direct-dialing intercompany microwave system.



CIRCULAR LOBBY, cantilever ramp, aluminum nuclear symbol are first-floor features. Ramp leads to patio, 13 executive offices, board room



Russia's Hydro Progress Extolled by Visitors

Sen Moss says, 'One cannot help being impressed . . .' while Sen Gruening states the U. S. has lost its hydro lead

Members of an 11-man U. S. government group touring Russian hydro-electric facilities will return to this country in a few days, with several members making a side-trip to Alaska to view the site of the proposed 4-million-kw Rampart Dam on the Yukon River.

The group—composed of three senators, four Senate committee aides, two independent engineering experts, plus Clyde Ellis, manager of the National Rural Electric Cooperative Assn, and Alex Radin, manager of the American Public Power Assn—left the U. S. on Sept. 15 (EW, Sept. 14, p 20).

They are expected to make a strong pitch for expanded federal development of U. S. multi-purpose dams on their return. Sen Frank Moss (D-Utah) gives an idea of the group's attitude in a letter which states in part:

"Oct. 4, Sunday — Visited the great Stalingrad Dam and power station. It is tremendous! Bigger by far than Grand Coulee . . . Oct. 6—Today we have visited the great Kuibeshev Dam—largest in the world. One cannot help being impressed with the vision and drive of the Soviet people. They conceived and built this dam from its first inception in only seven years. Its capacity is 2.3-million kw as compared with 1.9-million kw for Grand Coulee. We were briefed on the details of the plant, its building and its transmission lines. The Russians are doing great things in long line transmission at high voltage."

Gruening Notes Yangtze Plan

Sen Ernest Gruening (D-Alaska), another member of the U. S. delegation, commented that America has lost its leadership in hydro power projects to the U.S.S.R. "The axis of development has passed from the United States to the Soviet Union," he said. And he added that his group again was told of a proposed dam on the Yangtze River in China, which will produce 12 times as much power as Grand Coulee.

None of the publicity on the group's views has brought out the point that the Russians already have shifted major emphasis from hydro to steam generating stations. Nor have the stories brought out that most of the economically justifiable U. S. hydro sites already are utilized or plans for their utilization have been announced by their developers.

For readers interested in a critical review of Russia's projected 7-year plan 1959-1965, Electrical World next week will feature an article by Philip Sporn, president of American Electric Power Co. The Sporn article will point out that the Russian program actually relies heavily on expanding use of fossil fuels—coal, gas, and oil—and it de-emphasizes hydro.

King Hails U.S. Power Leadership

The U. S. leadership in electric power, the energy's widespread application and its low cost were among the points stressed Oct. 21 by Allen S. King, Edison Electric Institute president, on the 80th anniversary of Edison's development of a practical incandescent light.

The U. S. is actually increasing its lead over the Soviet Union in developing electric power, King said. "In 1957, U. S. capacity was 146,221,000 kw—nearly 98-million kw greater than the reported total for Russia of 48,350,000 kw." At the end of 1958, the U. S. figure was 160,219,000 kw, or 107-million kw over Russia's capacity, he said.

"During 1958, when America was adding some 14-million kw of capacity, Russia was increasing its capacity by 4,650,000 kw—about one-third of the U. S. addition," said King, who is also president of Northern States Power Co.

A goal of 108-million kw has been set by the U.S.S.R. for 1965 "but by 1965, the U. S. should have 245-million kw," King said, for a lead of 137-million kw.

King said, "Today's electrical commonplaces would have been viewed as miracles less than 100 years ago, and we accept possibilities for the future that would have been dismissed not long ago as insane fiction." He cited industries such as chemicals and aluminum which would not have been possible without electricity.

Since Edison's 1879 breakthrough, average price for electricity has decreased from 25¢ per kwhr to 2.53¢, despite inflation, King pointed out. Today's average price per residential kwhr "is about one-third of what it was in 1913 . . . and the cost of living is nearly three times as great."

Edison's own investment of $40,000 plus the $300,000 ventured by a group of businessmen was termed significant "at a time when there is much discussion of the relative merits" of U. S. and Russian economic systems.

Today, total plant and equipment of U. S. investor-owned companies is valued at approximately $44 billion, King pointed out.

Boiler Explosion Brings Emergency Repair Contract

An Oct. 7 gas explosion in boiler No. 2 of Los Angeles Dept of Water & Power's Scattergood plant has led to an emergency repair contract which city commissioners approved Oct. 15.

The explosion caused substantial damage to the boiler and to duct work leading to the stack. The 156-Mw turbine-generator was on test when explosion occurred in the gas-fired, 1.2-million-lb-per-hour, 1,850-psi boiler.

It is believed that loss of flame on the furnace burners resulted in unburned gas which exploded in the passageways. Combustion Engineering, Inc, manufacturer and erector of the boiler, will handle the restoration.

INFORMATION EXCHANGE between Soviet Union, U. S. became probable after Vienna sessions, subsequent exchange visits. USSR's L. M. Zamyatin, left, is talking with Paul F. Foster, AEC's deputy general manager, center, and Dwight Ink, U. S. delegate

International A-Agency Takes Realistic

The next decade is expected to be a period of preparation for the depletion of local fossil fuels, particularly in less developed countries. Construction cost evaluation indicates $280 per kw in 1967-70 period

F. H. BAER, Correspondent, McGraw-Hill World News, Vienna, Austria

Engineers and economists took a realistic approach to problems of nuclear power development during the recent annual conference of the International Atomic Energy Agency. Their findings contrast with the impatience of laymen, including diplomats and orators, to get heat and electricity from fission.

Representatives from 70 countries heard that the world's total power generation from conventional sources in 1954 was an estimated 1,342-billion kwhr. By 1963 this is expected to reach 2,500-billion.

Nuclear power is expected to produce 18-billion kwhr in 1963, as judged from announced projects.

Of the 70 IAEA member countries, 21 are interested in nuclear power. Their delegates realize the coming decade is a preparation period for the nuclear age, since depletion of local fossil fuels has been announced by many countries to start in about ten years. After 1970, the depletion amount and area will increase steadily.

As a start in approaching this problem, delegates at last year's IAEA conference passed "Resolution 27" which called for a study of the nuclear power needs of less developed countries.

It appears that the agency needs two or three years to get needed data on the energy situation and the economic, industrial and social development of interested countries. Only then will it be possible to extrapolate figures and evaluate statements on reactor technology and nuclear power plant construction, operation, and maintenance.

From preliminary studies three categories of reactor types were set up. Two of these are regarded as of no immediate interest because of difficult technology and lack of experience. The third comprises:

- Pressurized-water reactors, small and medium size, using enriched fuel.
- Boiling-water units, small and medium size, using enriched fuel.
- Graphite-moderated, gas-cooled units for medium to big reactors using natural uranium.
- Graphite-moderated, pressurized water-cooled reactors, small to medium size, using enriched uranium.

Further studies will center on the economics of these four types. At this stage, no one can say with any certainty which of the four will emerge as the best-suited type from the technical point of view.

A fourfold investigation will evaluate power reactor types as to their suitability for the needs of less developed countries. Basic prerequisites include proved design, reliability and safety, designs ranging from small plants to 250 eMw, and response to power demand changes.

The need for universally appli-

IAEA Photos

FUTURE PLANS include 200-250-Mw reactor in India announced by Dr H. J. Bhabha, right, in discussion with Cole

HOFBURG, THE IMPERIAL PALACE, was scene of two-week meeting. At rostrum, left to right, are Sterling Cole, IAEC director general; Dr T. Sudjarwo, 1958 conference president; and Dr Paul Jolles, IAEA deputy director general

Approach

cable cost calculations has arisen in studies undertaken so far. The predominant factors, regardless of where or what conditions prevail, appear to be capacity, load factor, and financial charges (taxes, cost of money and depreciation). It was recognized, however, that a 10-to-1 difference in generating cost could be the range between best compared to the worst conditions.

In the search for promising sites, an examination of a country's industrial, economical and social development is necessary, the agency believes. A potential area would include those countries where nuclear fuel cost is competitive with conventional power sources even though nuclear plant construction cost is higher; where fossil fuel imports strain the foreign exchange; or where eventual emphasis on nuclear power necessitates accumulation of experience.

The experienced countries already have assisted less-developed member nations of IAEA on technical designs, money and delivery of fuel. Another important contribution is the training of engineers and technicians. In 1958, the agency received 279 applications for fellowships, 113 of which were in the field of reactor operation. This year, 161 out of 491 applicants chose the same field.

Agency staff members are certain that situations in IAEA member countries will be found where nuclear power can compete almost immediately. As a case in point, India announced the start of preliminary work on a 200 to 250-Mw nuclear plant in a region where a cost of 7 mills per kwhr will be 0.2 mills under conventional power cost.

The agency, however, is also looking with interest into situations showing only marginally unfavorable balance where, for instance, excess cost can be regarded as the price for gathering experience. The country concerned would have to decide whether it would—and could—be willing to pay that price.

At the Vienna session, the Organization of European Economic Cooperation predicted a drop in the

(*Continued on page* 121)

Computer Analysis of Outage Data

Trend in analyzing outage data is made evident in informal and formal talks at two-day Texas committee meeting

Application of computer techniques and data processing for analyzing distribution system performance is accelerating. An increasing number of utilities are turning to machine analysis of interruption data as a vital tool for improving distribution system reliability.

The trend was plainly evident in both corridor conversation and formal presentations at the recent Houston, Texas, meeting of the Edison Electric Institute Transmission & Distribution Committee. Thirteen of the more than 30 electric utility companies represented report use of data processing machines for analyzing outage data. Four papers on the two-day program dealt with individual company programs.

Indices Evaluate Reliability

First of the papers dealing with computer analysis of service interruption reports describe an automatic cataloguing and reporting system recently initiated by Southern California Co. Differences in geography, weather, load concentration, and contamination among districts of the company led to selection of several indices for evaluating service reliability. These were: Minutes of interruption per customer per year; peak Mw-minutes of interruption per peak Mw demand per year; number of interruptions per 100 miles of line per year; customer minutes of interruption per mile of line per year, and total interruptions over the last 12 months.

A report is prepared annually of repeating circuit outages that lists all circuits interrupted more than a specified number of times. Also listed are circuits experiencing total interruptions in excess of a specified number of hours and those experiencing partial interruptions in excess of an accumulated period of hours. This report is expected to point out areas where work is most required to improve the standard of service, M. F. Mosquini said.

Harold R. McNutt, West Penn Power Co, said that since February, 1958 his company has used a single trouble report form to record service interruption so that it may be readily coordinated for analysis by electronic data processing. Known as a "service, trouble, failure and interruption report", it is the only detailed record of an interruption occurrence. From it, cards are prepared monthly for machine analysis. Quarterly and annual reports used as reports are sent to each district as engineering and operating tools to guide distribution system design and improve service reliability.

A third form, the outage report used by Cleveland Electric Illuminating Co., was described by Harold L. Williams. Like the others, this company uses electronic data processing to analyze performance and outage records to achieve better understanding of distribution system troubles and their remedies. In addition to the use of the summary for short and long-range planning, the company uses outage data to gauge the effectiveness of new construction, maintenance, tree trimming, and specific projects in poor-performance areas.

Rapid growth of the Texas Electric Service Co. system since 1955 has made it increasingly difficult to analyze load balance between feeders on the company's 12.5-kv system to determine voltage drops, fault currents, line losses, and other conditions pertinent to budgetary decisions. A computer program developed to produce such a phase-balance report was described by G. P. Rhoten. Using this method, an engineer can prepare a budgetary report for the 50 feeders in the company's Fort Worth district in two weeks.

Rhoten also reported that a program which yields a report of interruptions to certain customers, and said that another is being prepared that produces periodic statistical summaries of faults and interruptions. The company's form for reporting major trouble has been re-designed as a source document machine analysis of data.

Prestretching of all-aluminum conductor on transmission lines does not permit installation at final sag as is the case with copper and ACSR, Clinton E. Calvert, Gulf States Utilities Co., told the T&D Committee. Recently in the construction of a 138-kv line, using 1,033.5-MCM, all-aluminum conductor, excessive sag developed in conductor that had been prestretched to 7,300 lb, held for 30 min and then sagged to final sag in accordance with past practice, he said. A field check two months after installation revealed 2 ft of extra sag, indicating that the conductor had been only partially prestretched.

All-aluminum conductor reacts differently, Calvert said, when a tension of 7300 lb is held continuously for 30 min and then sagged. This method, called "partial prestretching initial" sagging is in use by Gulf States. After a three-months' period, conductor sag changes very little. After ten years there are 8 in. less sag and 194 lb more tension than for the previous sagging method.

Scuba Divers Spot Cable Fault

L. L. Rayment reported procedures used by Cape & Vineyard Electric Co., in locating faulted 25-kv, 3-phase armored submarine cables linking Martha's Vineyard with the mainland. For this work, he said, skin-divers have distinct advantages over conventional hard-suited divers. Being without trailing lines skin-divers are more mobile and can cover many times more area. Tidal flow or current is no obstacle. Unlike a hard suited diver, he leaves the bottom undisturbed and so has better visibility. In the case of the Martha's Vineyard cable the Scuba diver working from a barge under storm conditions in water 83 ft deep and with tidal currents 4 knots inspected an area 600 ft. long. He located a missing single conductor cable and returned to the surface in about 30 min.

In presenting the underground

Growing, EEI T&D Committee Told

cable performance report for 1957, compiled by AEIC and EEI, Howard L. Davis Jr., Philadelphia Electric Co. observed that for the first time 25 to 45-kv class cable showed the largest increase in mileage. Until 1957 he said the 7.5 to 15-kv cable was by far the largest. The change is probably due, he said, to increased installation of cable in suburban territories where higher voltage distribution systems are used.

A study, instituted in January 1956 by the Union Electric Co of Missouri, indicated that the company can expect a net saving of $24,000 a year by establishing a crew to patrol, inspect, and maintain the 2,650 manholes of its underground system not under surveillance, C. E. Monfort reported.

Such a crew has been engaged in patrol work full time since April, 1958, he said. During the period from April 9, 1958 to July 7, 1959 the patrol effected a saving of $147,000. Among the defects found and corrected were 4,317 missing cable blocks, 474 missing cable pins, 1,988 misplaced cable shoes, 11 missing cable bonds, and 162 cables fireproofed.

Howard L. Davis Jr., Philadelphia Electric Co, told how radiography, using Iridium 192 (a radioactive isotope) made it possible to salvage 2,500 ft. of 138-kv pipe-type cable damaged when the skid wire caught on an obstruction during pulling. Using Iridium 195 as a source of gamma rays, made it possible to photograph, identify and remove damaged cable sections.

Rectifiers Feed D-C Network

Twelve, 250-kw oil-cooled submersible silicone rectifiers have been supplying an estimated 1,600-kw load on the d-c network of the Boston Edison Co for the past year in a "very satisfactory" manner, Charles W. Smith Jr. reported. The rectifiers are supplied with 3-wire, 3-phase, 120/208-v ac service from a 300-kva transformer connected to the 4,160-v primary system. Ten are in sidewalk vaults.

Smith reported that in the 178 rectifier months of operation, four blown rectifier fuses and seven blown output AMP TRAP fuses have been experienced. This favorable experience is leading directly to consideration of the installation of more units. These, Smith said, may be connected directly to the secondary network system, eliminating the separate power transformer now used in each existing installation.

About 65% of the electric utility operating companies replying to a recent survey approved the locked-rotor starting currents for air-conditioning equipments compiled by the AEIC-EEI-NEMA Joint Committee, Chairman J. W. Anderson reported. Of the 52 responding, 34 found the proposals satisfactory, and 18 offered some objection. All except one objection found proposals "too liberal." Anderson indicated, that the degree of objection was slight.

W. J. Witte, Baltimore Gas & Electric Co, said that he felt the limitations were too liberal and expressed concern that they might create flicker and require reinforcement of secondary systems in medium and light-load density residential areas.

(*Continued on page* 119)

System & Equipment Group Sees Recruiting Lag

The difficulties of utilities in recruiting young engineers have their origin in the secondary schools; they are traceable to a shortage of mathematics teachers and the generally poor preparation of students for engineering education.

Speaking as a member of the panel that discussed the recruiting and training of engineers at the Kansas City meeting of the Electrical System & Equipment Committee, E. G. Huck, Cincinnati Gas & Electric Co, said that utility recruiting efforts need strengthening. Utilities are not getting their story over to students, and that story is not clear and suffers by contrast with the presentations of other industries.

J. H. Vivian, Southern California Edison Co, said that summer employment of engineering students is a fruitful means of securing permanent engineering employees. But he reported a somewhat less favorable results in direct recruiting. Among 256 students interviewed this year, 151 applied for jobs, 48 obtained offers, and ten accepted.

W. D. Fish, Consolidated Edison Co of New York, reported poor experience with the employment of summer students. In direct recruiting at schools about 10% of the 340 prospects finally were employed.

J. L. Wheeler, Cleveland Electric Illuminating Co, described the formal program of appraisal and guidance instituted by his company to guide the development of young engineers in his company.

W. H. Lambert, Pennsylvania Electric, told the committee that the 460-kv experimental transmission line to be built under GPU sponsorship, between Claysburg and Saxon, Pa., is approaching the construction phase. Structure design for the 13-mile wood pole line has been completed, and a sample successfully tested. Conductors have been engineered, Lambert said, and relaying is ready to order. Terminal substations are being designed.

Accuracy in forecasting loads is vital in establishing economic combinations of units to use during valley and week-end periods, said W. P. S. Schmidt, Monongehela Power. The large number of calculations required under rapidly changing system conditions makes a high-speed computer necessary. Schmidt pointed out that no computer program has been developed that selects the proper combination of units for a given load.

R. L. Philips, Kansas City Power & Light, described the operation of the GE load control used by the

(*Continued on page* 119)

Sees 1-Mill Refueling for Reactor

NELPA speaker says uranium as fuel is lower than coal or oil; Mica Creek dam urged

Canada expects to realize refueling costs as low as 0.08 to 1.0 mills per kwhr in its first full-scale power reactor, the Northwest Electric Light & Power Association was told at its meeting at Vancouver, B. C.

This means, said Dr W. B. Lewis, Atomic Energy of Canada, Ltd, that uranium is three to four times cheaper as a fuel than coal or oil on the basis of an expected 10,000 (t)-Mw-days per ton. In arriving at these figures, no values have to be assigned to plutonium production or to depleted uranium, he added.

Furthermore, fuel can be changed in the 220-Mw Candu reactor while it is operating at full power. Thus, the final inspection cost of uranium fuel can be eliminated by the performance of this task in the reactor itself.

Mica Creek Dam Urged

The natural uranium heavy-water moderated reactor is designed to operate at 550F and 1,500 psi, using zirconium-clad uranium oxide fuel elements in stainless steel pressure tubes, Lewis told NELPA. A third or fourth reactor of the Candu type, generating 350 Mw, he said, would have a capital cost of less than $250 per (e)kw and a refueling cost of less than 1 mill per kwhr.

The meeting heard Dr A. E. Grauer, BC Power Corp, urge a high dam at Mica Creek on the upper Columbia River, B. C. This facility, he said, would permit U. S. plants on the lower river to produce 1,700 Mw at a good load factor.

One effect of the further development of Canada's three big rivers—the Peace, Columbia, and Fraser—could be the postponement of U. S. thermal plant investment, allowing more attention to nuclear progress.

Nuclear plants to compete with thermal plants would relieve the pressure to build power dams on the Fraser River, said James Sinclair, Fisheries Association of British Columbia. Were the Fraser fully developed, he said, it could produce 6 million kw, but it would quickly end that river as a leading source of salmon, a $98 million B.C. industry.

Import competition and falling sales have forced several Canadian industries to close their doors or reduce their labor forces, said Ian F. McRae, Canadian General Electric Co, Ltd. The dominion's small domestic market and high-cost labor make it vulnerable to competition, he said, urging a national tariff policy for safeguarding Canada's manufacturing industries.

Asks New Techniques

Improved management techniques are necessary today in the electric utility field, said L. E. Dake of Cresap, McCormick & Paget, management consultants. He urged new techniques to overcome the increasing difficulty utilities encounter in obtaining rate increases.

He urged especially one method of reducing costs horizontally across the business organization, following the communications lines which tie an organization into a team. He said that it was wrong merely to superimpose modern equipment, such as data processing and electronic computers, on an outmoded organization and on procedures which need improvement.

The focal point of a sound control system, he said, is planning, with budgeting to follow. Budgets along with performance reports often fail to reveal meaningful operating information.

Proposed Planning

Planned industrial estates would benefit industries and society generally, said Gen Sir O. L. Roberts, Grosvener-Laing Ltd. Such planned industrial estates, he said, would prevent one industry from building in such a way as to detract from the appearance of a neighboring industry.

The U. S. electric industry, despite a general economic recession, added 13 million kw of new generation capacity during 1958, said Allen S. King, president, Edison Electric Institute. New plant and equipment expenditures, he said, represent about 12% of the total expenditures for new facilities by all American industry during that year.

King of EEI Speaks

King noted that 131 U. S. investor-owned utility companies are participating in one or more of 27 nuclear power development projects, costing more than $570 million. Several companies, he said, have committed themselves to the installation of large critical-pressure units, with the expectation that only ⅗ lb of coal may produce 1 kwhr in the very near future.

In 1958, thermal plants generated 78% of the electricity produced by the electric industry, he said, noting that 75% of TVA production is now thermal. Such production by TVA, he said, is a departure from the original idea, which was to produce electricity incidently to irrigation and flood control.

FUEL ELEMENT of Canada's NPD demonstration reactor is discussed by Dr W. B. Lewis, Atomic Energy of Canada, Ltd, with two delegates to NELPA convention at Vancouver

Comparative Cost of Transformer Substation Protective Schemes

	Relative Cost %
1. 138-kv OCB and local transformer relaying	100
2. Carrier transfer trip, local transformer relays, automatic air break switch for isolating transformer. No 138-kv CB	48
3. Carrier transfer trip and local transformer relays. No 138-kv CB or automatic isolating transformer switch	39
4. Automatic transformer grounding switch, automatic transformer isolating switch, local transformer relays, No 138-kv CB or carrier relaying	34
5. Automatic transformer ground switch, local transformer relays, No 138-kv CB or carrier relaying, or automatic isolating transformer switch	27
6. 138-kv OCB and complete carrier relaying terminal	131

Cuts Substation Protection Costs

Automatic grounding switch costs only 34% of the amount 138-kv oil circuit breaker, local relaying would cost

S. A. **OLSON**, Staff Engineer, Commonwealth Edison Co, Chicago, Ill.

Step-down transformer substations for supplying large industrial customers are tapped to transmission lines more and more on the Commonwealth Edison Co system.

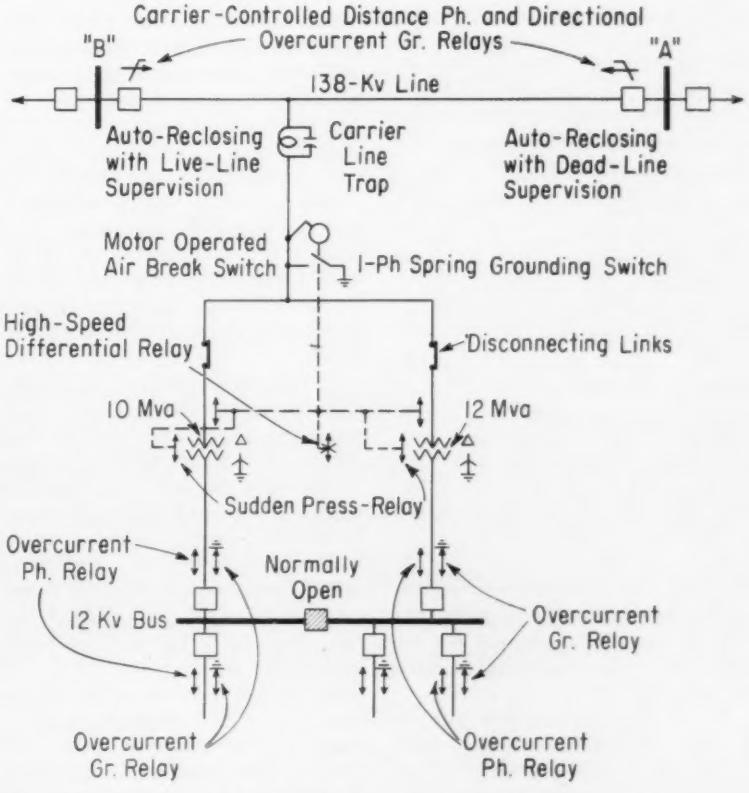
For economic reasons, and because transformer failures are few, automatic grounding switches are installed at these substations to trip the circuit breaker at the line source when there is a fault in the substation transformer. Such installations need neither high-voltage breaker at the substation nor complicated relay protection.

Commonwealth Edison is expanding its use of these simplified transformer stations by tapping them to conveniently located, yet important, 138-kv lines. The latter have carrier relaying and automatic reclosing facilities. These service stations are equipped with 138-kv automatic grounding switches in combination with automatically opening air-break switches and simplified relaying. No carrier relaying is provided, and there is no 138-kv circuit breaker at the station.

Cost of this scheme is only 34% of that of a 138-kv OCB at the substation plus local transformer relaying. Relative costs of these and other schemes are shown above.

With the automatic grounding switch protection for a transformer substation, when a transformer fails and the fault is not detected by the distant terminal relays, the common transformer differential, the sudden pressure, or the high-side overcurrent relays operate to trip the low-voltage circuit breakers and close the 138-kv spring-operated grounding switch. The last applies a solid line-to-ground fault on the transmission line. This fault is detected by the carrier-controlled or back-up relays at the distant terminals, opening the terminal breakers and de-energizing the faulted transformer.

When the line has been de-energized, the 138-kv 3-pole automatic



AUTOMATIC GROUNDING SWITCHES and simple relaying protect line against faulted transformer by causing relays to open breakers at line sources

air-break switch opens to disconnect the faulted transformer from the line. Automatic reclosing relays then operate to close line terminal "A" circuit breaker (see drawing), energizing the line. As soon as the line has been energized the automatic reclosing relays at terminal "B" close that circuit breaker and restore the tie line to service.

These transformer substations have conventional relays. Where there are two transformers in the substation, as in the drawing, one set of high-speed differential relays is common to the two transformers. Each transformer has its own sudden-pressure and overcurrent relay.

Line and associated 138-kv tap faults are isolated by carrier controlled or back-up relays at terminals "A" and "B." Some high-side transformer faults may be detected by the line relays, which may then operate before the transformer relays. Such operation may re-energize the faulted transformer automatically from terminal "A." Under these conditions that terminal will retrip and lock out. As there are few operations of this type, they are accepted.

The sequence of operation that may be expected and the time required for isolating a faulted transformer and restoring service on the 138-kv line is as follows:

Steps	Sec
Fault in transformer at time	0
Differential relays operate in	0.033
Grounding switch operates in	0.25
Line trips at "A" and "B" in	0.10
Faulted transformer de-energized in	0.38
Time delay to be sure line is de-energized	5
138-kv air-break switch opens to isolate transformer in	8
Terminal "A" recloses in	2
Terminal "B" recloses in	0.25
Line restored to service	15.63

The transmission lines associated with these substations do not require high-speed reclosing facilities for stability.

Some consideration was given to a more general system application of the automatic grounding switch for use with a series resistor. This arrangement could not be economically justified.

230-Kv Fuses Prove E

Installation of 230-kv fuses to protect isolated system loads cuts capital expenditures for Washington Water Power Co

R. C. SAFRANEK, Electrical Engineer, Washington Water Power Co, Spokane, Wash.

Using 230-kv fuses instead of oil circuit breakers, Washington Water Power Co obtained satisfactory protection and saved $100,000 in capital costs at each of two substations serving isolated loads in the mountainous area of northern Idaho.

A preliminary study of cost to serve a lead and silver mine indicated that the expense would be prohibitive. About 25 miles of 13-kv line would have to be constructed over rugged terrain to furnish an initial load of 900 kw from the nearest distribution. However, an 80-mi long, 230-kv transmission line from Cabinet Gorge Hydro Plant to Spokane crossed the mountains within 4 miles of the mine.

2,500-kva Transformer Installed

Consequently, plans were prepared for construction of Lakeview Substation adjacent to the transmission line, along with 4 miles of 13.8-kv line to the mine. A 2,500-kva, 3-phase, 230-13.8-kv, 900-kv BIL transformer was installed to supply the load and provide for growth. Based on experience with 60 and 115-kv fuses, 230-kv fuses were installed to clear the transformer from the transmission line in the event of a bus or transformer fault.

To provide greater protection against corona damage than was necessary for lower voltages, an electrostatic shield was incorporated in the tube by imbedding several turns of conductive tape in the outer laminations of the fiberglass at a diameter of about 2 in. Both ends of the shield were bonded by rivets to hardware on the ends of the tube. Overall diameter of the basic tube is 2¼ in.

A problem inherent in all expulsion fuses is that of providing clear bore area for escape of gases and fuse element materials under high fault conditions without compromising reliability of operation under low fault conditions. This problem was particularly severe because of the long tube length and the necessity for a relatively large bore to accommodate the fuse element leader or pigtail as it was blown clear under force of escaping gases.

These conflicting requirements were resolved by providing a 1-in. bore in the basic fiberglass tube and enclosing the current responsive element in a separate replaceable-horn fiber-lined cartridge having a ⅜-in. inside diameter. The cartridge is less than 4 ft long, which leaves the lower 4 ft of the 8-ft basic tube bore unrestricted, except for the fuse link pigtail extending through it. High fault currents which might rupture the 1-in. fuse cartridge will still be cleared by the 2½-in. basic tube. The current responsive element is enclosed in a sleeve filled with boric acid to aid in clearing low magnitude faults and limiting arcing time for all values of fault current.

The current responsive elements consist of high tensile strength, high melting temperature copper-nickel alloy heater wires with a low melting temperature alloy joint. During long-time overload currents, heat is conducted to this fusible joint. The design provides a link which will operate at temperatures below the "char zone" for fuse tube walls and will withstand current surges without damage at any value which does not actually melt the link.

Fuses Mounted Horizontally

To facilitate re-fusing, and because of the weight involved, fuse mountings were designed for horizontal upright mounting rather than for vertical mounting. After the fuses were installed, a platform was erected between each phase for safe handling of the fuse tube. A man standing on this platform or on the base of the fuse can adequately handle the fuse holder with a 12-ft hook stick.

The hinge end of the fuse mounting is spring loaded. Operation of the fuse unit triggers a latch, caus-

Economical

ing the tube to swing upward to provide an open gap and indication of operation. Retarding springs are also incorporated to bring the holder to an easy stop as it reaches a vertical position.

One year after the July, 1956, original installation, one of the fuses was replaced with a spare and cut open in the shop. Inspection of the fuse elements, pigtails and other parts revealed no corona damage or deterioration. On June 6, 1958, a direct lightning stroke on the 12-kv feeder just outside the substation resulted in failure of a 15-kv recloser and a phase-to-ground fault on the 13-kv bus. Two of the high side 230-kv fuses blew, clearing the fault.

Second Set Installed

A second set of 230-kv fuses was installed in August 1957, to protect a 5,000-kva, 3-phase, 230-13.8-kv transformer supplying construction power to the Noxon Hydroelectric Project. On November 7, 1958, during a wind and rain storm, a long sliver of wood became lodged between the top of a 230-kv lightning arrester and an adjacent wood pole structure. The resultant phase-to-ground fault was cleared when a 230-kv fuse blew.

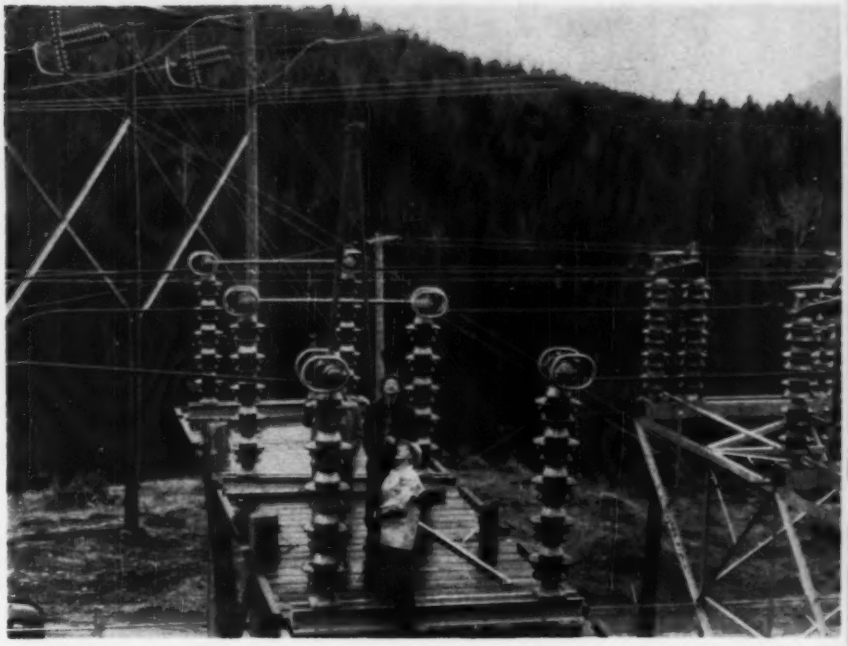
In both cases of trouble, the fuses operated properly, clearing the fault satisfactorily without damage to fuse holder or parts.

Other methods of protecting power transformers had serious drawbacks. A 230-kv oil circuit breaker involves substantial capital outlay. On the other hand, the inexpensive solid tie has the following disadvantages: The transformer may be destroyed in case of fault; there is no secondary back-up protection; and integrity of the 230-kv transmission system may be jeopardized.

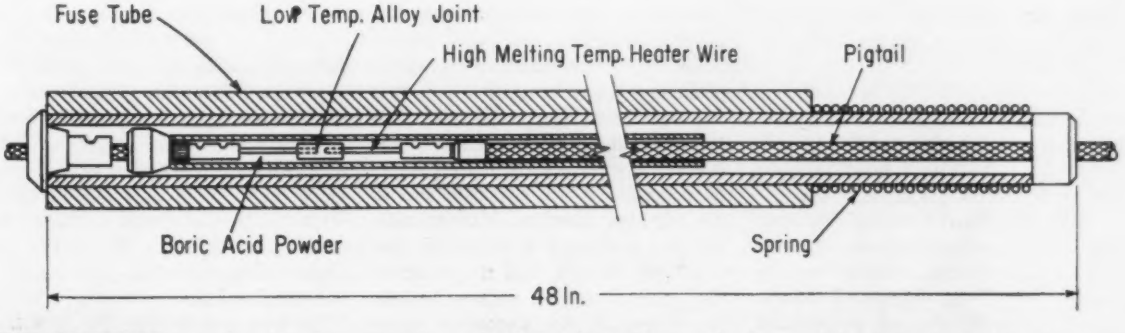
Between these extremes lie the high-speed grounding switch, remote trip relaying and the power fuse. Except for the power fuse, they are relatively expensive and complicated because of the relaying involved.

The fuse is not required to interrupt high side faults, as high speed carrier relays and oil circuit breakers are used for this function. The primary purpose of the fuse installation is to provide protection to the transformer from low-voltage bus faults, back up the low voltage breaker, and prevent excessive damage due to an internal transformer fault of lower magnitude than 230-kv relay settings.

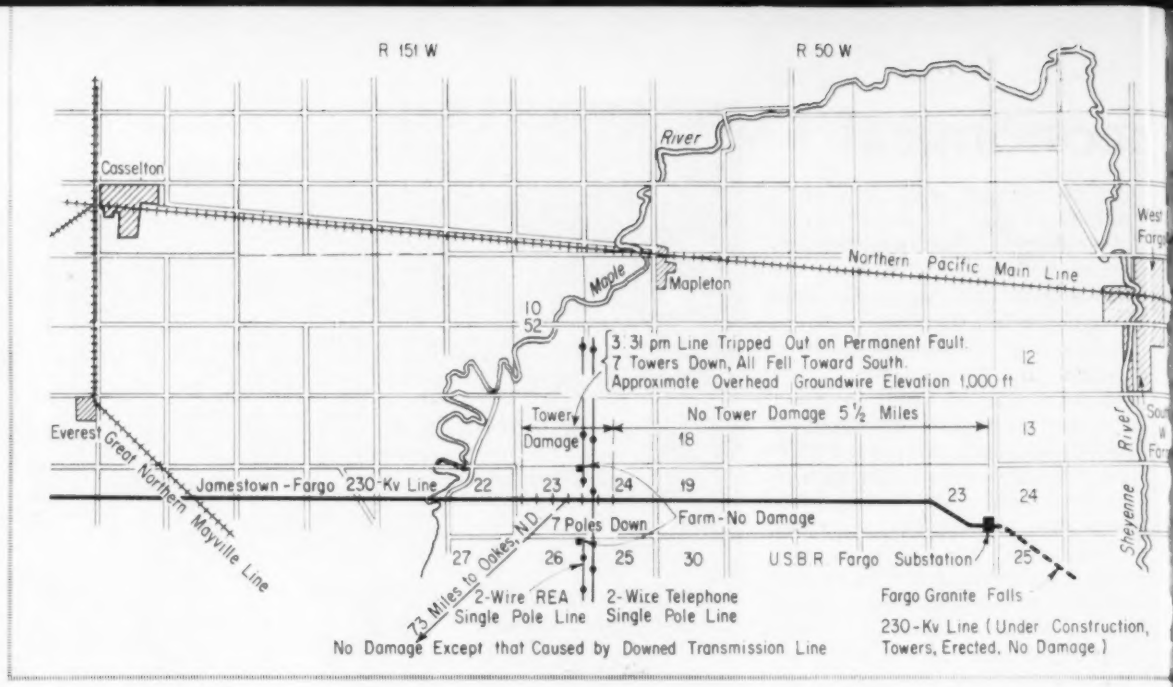
The design of the 230-kv fuse was based on experience with 115, 138 and 161-kv fuses.



FUSES ARE MOUNTED in a horizontal position to facilitate re-fusing with a standard 12-ft hook stick. A platform was built for safe handling of fuses



FUSE CARTRIDGE is enclosed in 1-in. fiberglass tube 8 ft long and 2¼ in. diameter. The cartridge is less than 4 ft long, leaving the lower 4 ft of the basic tube bore unrestricted, except for the pigtail extending through it



Tornado Winds Over 125 Mph

USBR cites Weather Bureau data for June 9 in explaining seven failures on Jamestown-Fargo (N.D.) transmission line

Tornado winds of unknown velocities, but exceeding 125 mph, toppled seven standard suspension towers of the Jamestown-Fargo, N. D., transmission line last June 9, the Bureau of Reclamation has reported.

The Weather Bureau Station at Hector Airport, Fargo, reported winds on June 9 up to 115 mph and a tornado, along with a severe thunderstorm in the airport's vicinity. The airport is some 13 miles from the fallen towers. Indicating that the damaged line section was subjected to pressures greater than those for which the line was designed are these excerpts from the airport weather log:

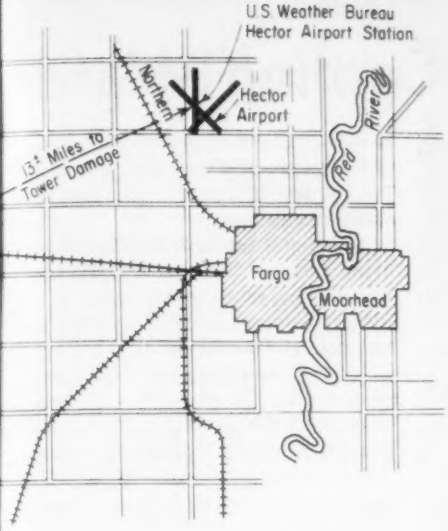
- 2:40 pm Unconfirmed funnel clouds reported between Casselton and West Fargo.
- 2:58 pm Heavy cloud moving northeast from thunderstorm, which moved from vicinity of Oakes, N. D., to a position west by northwest of Fargo.
- 3:10 pm Tornado funnel cloud which touched the ground just north of airport, moving east by northeast.
- 3:12 pm Severe thunderstorm northwest of airport, moving northeast.
- 3:40 pm At airport, windspeed indicator remained at 100 knots (115 mph) mark (end of scale) for about ½ min. Direction is northwest.

Failures occurred about 3:30 pm. Six of the seven towers fell over straight to the south, and the seventh, on the east end of the break, lay to the south in an arched position. From its position, it was inferred that the unbroken conductors had pulled the arms of the tower under the body. Stub angles were bent, but the concrete cap of the pile-type footings was not displaced. Although it appeared that a tornado funnel had not touched the ground there, structures can be subjected to excessive pressure without a "direct hit." An explanation of this is offered on page 675 of "Compendium of Meteorology," published in 1951 by the American Meteorological Society, Boston, Mass, as follows:

"The radial motion in a tornado is inward near the ground. The winds in different tornadoes or even within one tornado probably blow inward at different angles to the radius, depending on the ratio of inflow and tangential speeds. Along many tornado tracks, evidence for the inflow is much clearer than evidence for the rotation, which suggests that, in these cases, inflow speeds may be greater than tangential speeds except near the center."

Specifications Exceeded

The damaged towers had been designed for mechanical characteristics exceeding by substantial margins the minimum requirements of the National Electrical Safety Code (EW March 11, 1957 p 101). Combinations of ice and wind loading, such as had been experienced in that North Dakota area, had been duly considered in the tower design which exceeded code requirements for heavy loading districts. This was true despite the fact that the towers, as constructed, were somewhat lighter than those of



U. S. Weather Bureau Shows Local Climatological Data for Hector Airport

Day, June 1959	Temp. F, Ave.	Wind				Sunshine		Thunderstorm or Distant Lightning
		Prevailing direction	Ave. Speed Mph	Fastest Mile		Total Hr. Min.	% of Possible	
				Speed-Mph	Direction			
1	62	SSW	10.7	18	S	15:16	98	
2	69	SSW	16.1	25	S	10:01	64	
3	73	S	15.7	26	SE	14:07	90	
4	79	S	17.0	30	SE	9:25	60	T
5	74	S	11.0	18	S	13:25	85	
6	83	S	16.9	22	S	13:08	83	
7	85	S	27.3	40	S	15:46	100	
8	76	S	14.2	28	NW	5:53	37	T
9	71	ESE	14.4	115	NW	7:53	50	T
10	78	SSE	21.2	32	S	10:44	68	T

Topple Transmission Towers

earlier design for use in that region.

In designing the towers, the Bureau had considered these factors as warranting a weight reduction of about 25%: The use of less conservative loads in the calculations; more extensive use of high-strength steel and reductions in wire configuration dimensions. These, taken together, were believed to justify lighter construction.

Yet the overall safety factor was 1.25 and was applied equally to each of three basic loading conditions:

1. Vertical and transverse loads based on ½-in. radial ice, 8-lb wind on maximum spans for conductors and ground wires, plus an unbalanced longitudinal load of 4,500 lb at any one conductor or 32,000 lb at either ground wire.

2. Vertical and transverse wire loads based on 1-in. radial ice, 4-lb wind on maximum spans, no longitudinal unbalance.

3. Vertical and transverse wire loads as in **1,** plus an unbalanced longitudinal load of 8,500 lb at any one conductor, or 7,000 lb at either ground wire. This applies only to that portion of the tower above the knee-brace panel point.

All three cases include the tower's dead load and transverse wind loading of 13 psf on it. In **1** and **3,** a full 8-lb wind loading, rather than the 4-lb loading specified in the code, was used. The Bureau provided for longitudinal loads applied simultaneously with vertical and transverse ones. The code, on the other hand, specifies no longitudinal strength, except at deadends.

Margins Revealed

The following comparisons reveal the wide margin by which the Bureau's tower exceeds the basic code requirements for transverse strength:

1. The code requires transverse strength overload capacity of 2.54 on a ½-in. ice, 4-lb wind condition, plus a vertical strength overload capacity of 1.27. This requirement would produce a maximum ultimate compressive leg stress of 29,300 psi in the Bureau tower (with maximum permissible spans), in contrast to the allowable ultimate stress of 37,200 psi, which is more than 1½ times the code requirement with its multiple overload factors.

2. The code requires an overload capacity factor of 1.1 for a transverse load on the tower alone, without wires, of six times the specified 4-lb wind pressure. This rule gives a tower wind loading of 42.3 psf, equivalent to a wind velocity of 103 mph. The Bureau tower, without wires, would require a 224-mph wind to cause failure, or over twice the code requirement in terms of wind velocity.

Before mass production, the Jamestown-Fargo line tower type was given load tests at the fabricator's. One test of maximum transverse loading used loads equal to 1.25 times those that would be taken by the tower with all wires intact, 1-in. radial thickness of ice, 4-lb wind on the wires, and 13-lb wind acting on 1½ times the exposed area of members in the tower's transverse face. The structure held steadily longer than 5 min.

In terms of critical leg stress, this loading equals a wind of about 110 mph on all wires and the tower, with no ice, plus the vertical weight of bare wires and the tower. In terms of ultimate stress capacity of the critical leg, the test tower could withstand loadings up to the equivalent 125 mph on structure and bare wires.

Thus, calculated strengths indicated that wind velocities would have to exceed 117 to 127 mph to cause failure of the seven towers, with their span lengths and overall heights.

Generator Waste Cooling Water H

Reclaimed heat proves economical, reliable heat-pump supply for McNary and other Columbia River hydro plants

ROLAND E. OTT, Head, Air Conditioning Subsection, U. S. Army Engineer Division, Portland, Ore.

Heat pumps use waste generator cooling water to heat McNary and other hydro plants built by the U. S. Army Corps of Engineers on the Columbia River. The McNary installation, the first, was designed as the result of a study, showing that the electrical load of heat pumps would be much less than that of resistance heaters. Estimated savings approach $20,000 a year.

The air conditioning units have finned coils through which heated or chilled water is pumped. Two 4-way valves switch the water flow at each heat pump, and an air switch, or outside thermostat, initiates switchover from heating to cooling. Warm water discharged from the generator air cooler constitutes a reliable heat source.

Costs of interest, replacement, maintenance, and power in winter are expected to be much less than those of resistance heaters. Moreover, the heat pumps give chilled water for making the control room, offices, and other areas comfortable in summer. A "dead-spot" temperature range control keeps the pumps from short-cycling on and off when neither heating nor cooling is called for.

Calculations of needed capacity revolved around McNary's heating load and showed that three 165-ton centrifugal heat pumps would do the job reliably. More than 300 tons of refrigeration capacity were available, predicated on the nominal 14,300 Btu/hr/ton of heat from the compressor motor.

Soon after the McNary air-conditioning began operating in 1954, the heating capacity of its first heat pump was tested. Data yielded a coefficient of performance (COP) of 6.0, based on evaporator refrigerant temperature of 56.85F and condenser refrigerant at 117.7F. Comparison with the highest theoretical COP, 9.48, based on the Carnot cycle, gave a refrigeration equipment efficiency of 63.2%.

Conditions Simulated

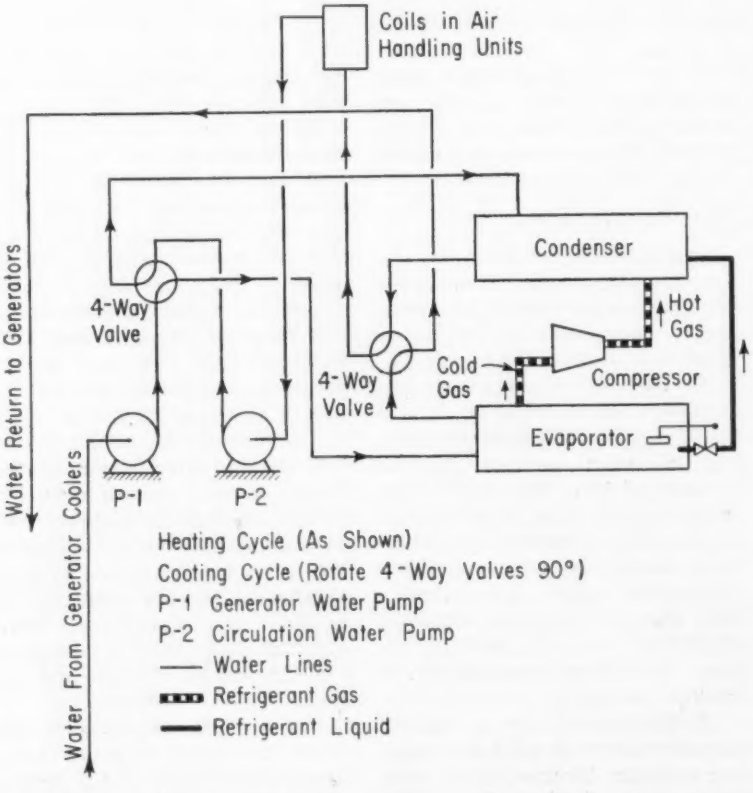
In the test, design conditions were simulated; design temperatures were maintained in the evaporator and in the condenser. With this temperature differential kept constant, the compressor had to pump through the design thermodynamic head.

Design gas flow was kept up by subjecting the system to the design heat flow, involving maintenance of design water flow and water temperature differences. Accordingly, the compressor motor was loaded to its maximum horsepower requirements under design conditions, and the horsepower input to the compressor was measured and checked against the maximum permitted by specifications.

Condenser and evaporator tubes were checked for area and heat transfer capacity. This check was made as a consequence of the tubes having become fouled by river water impurities. Although designed with a fouling factor of 0.001, the tubes tested were clean ones, as the heat pumps had been in operation only a short while.

As a result of the latter test, greater-than-design heat transfer was offset by decreasing the mean temperature difference between the refrigerant and water temperatures in both the evaporator and the condenser. This adjustment holds heat output to design capacity. The test results also afforded the Corps a means of foretelling the equipment's output when the tubes are fouled.

Information was meager in 1948 on the design of heat pumps, and especially on suitable control systems.



HEAT-PUMP INSTALLATIONS at McNary and other Columbia River hydro powerhouses built by Army Corps of Engineers follow layout in this schematic

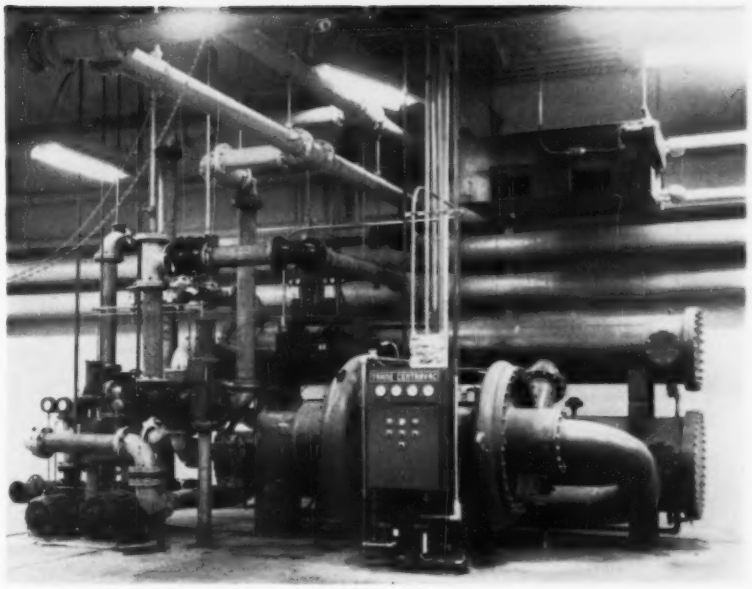
r Heats Plant

Normally, refrigerating equipment is controlled by the temperature of the evaporator or by chilled water. But in the heat pump, the condenser must control the heating cycle; the evaporator, the cooling cycle.

Accordingly, provision had to be made for interchanging the flows of water between the condenser and the evaporator in changing from the heating to the cooling cycle, and vice versa. The piping had to be compact with two water pumps in its system, and access to the equipment for maintenance was a major consideration.

A test at Bonneville Dam determined the flows and temperatures of generator water. Heat runs on the equipment were recorded during the rise of water temperature and flow. The units' electrical losses, however, were not found by a new test but were taken from the data accumulated during the generator acceptance tests.

As the temperature of water in the forebay varies seasonally from 32F to 74F, its regulation was desirable. The generator piping for cooling was therefore designed with an air-operated modulating valve on the coolers' discharge side together with a pneumatic thermostat to control it.



McNARY POWERHOUSE control room and offices are made humanly comfortable by three 165-ton centrifugal heat pumps, using waste generator cooling water

Placed in Air Stream

Although the thermostat's bulb was designed to be placed in the discharge water line, operational experience dictated its placement in the generator cooler discharge air stream, where it has given more stable operation of the modulating valve. The bulb is protected by a brass pipe containing a row of holes. The pipe turns in its holder to afford the exact sensitivity desired by permitting the right amount of air to affect the bulb through the holes.

Switches on the governor cabinet remotely operate solenoid air valves which put the modulating valve under control of the thermostat whenever a unit is put on the line. The modulating valve's air controls do not allow the valve to close completely during operation, this provision assuring a pre-determined minimum flow of cooling water through the generator in all operations. The modulating valve's "fail-safe" features open it when electrical power to the solenoid valves fails or when air pressure is lost.

Successful operation of the McNary heat pumps can be attributed, in part at least, to the safety control, which has kept the motors from overloading. Inherently, a centrifugal compressor pumps greatly increased amounts of gas with only a small reduction of differential gas pressure. This is a probability at heating-cooling cycle switchover, or at any time when the thermodynamic head is too small. The compressor motor then tends to overload.

The control then measures the current in one motor lead and operates an electric-pneumatic relay. The latter closes the inlet vanes to the compressor, thus snatching control from the thermostat until the abnormal conditions change.

Two reciprocating refrigeration compressors were selected for the Detroit powerhouse, where the heating load was not enough to justify centrifugal units likes those at McNary. A safeguard against damage caused by slugging was built into the compressors. This took the form of cylinder heads which relieve under spring pressure whenever liquid refrigerant or oil is in the cylinders. With intermittent operation of the anti-slugging heads, the Detroit heat pumps have given satisfactory operation for several years without extraordinary maintenance.

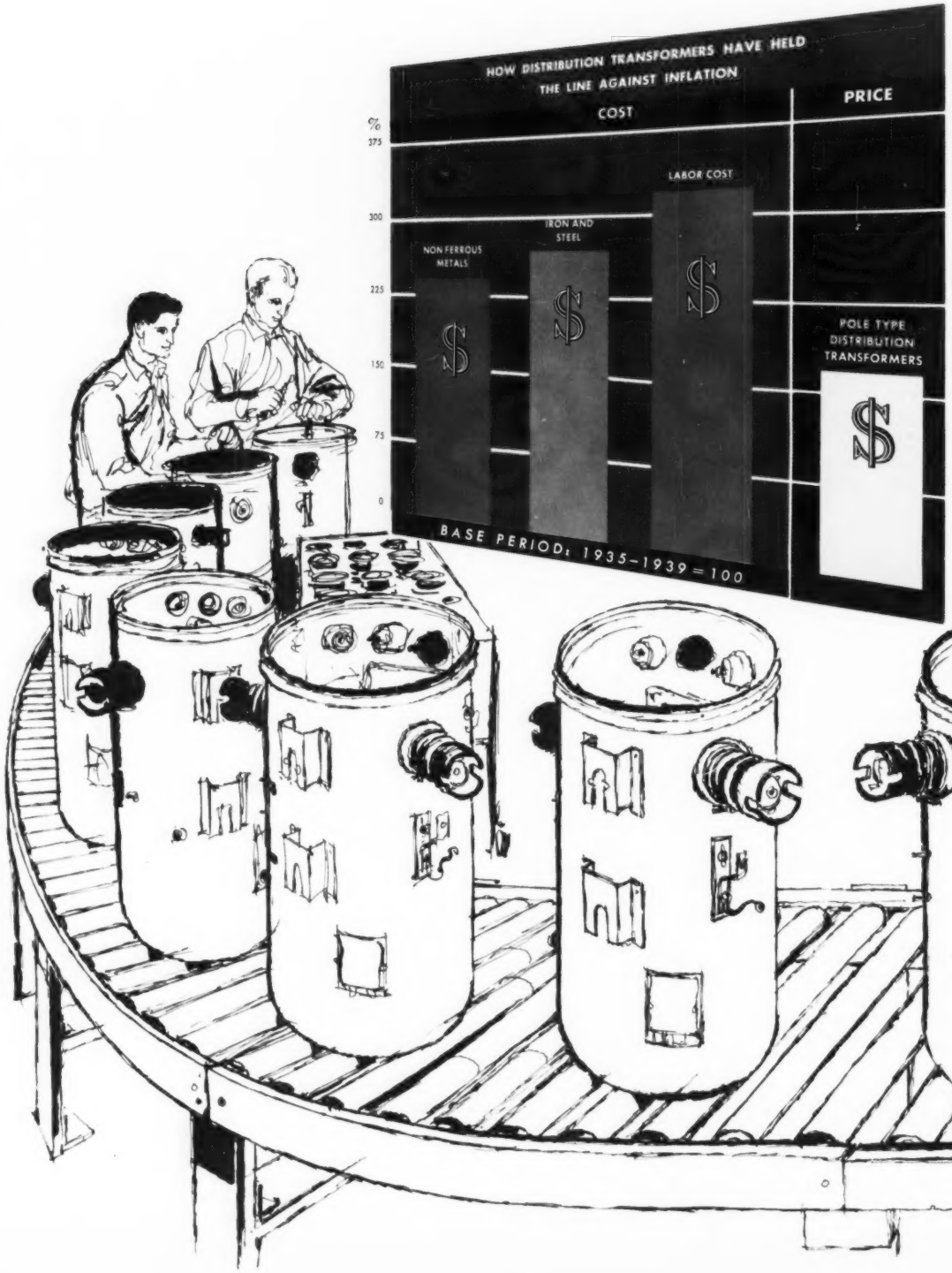
Slugging in a reciprocating compressor, when severe, can break valves, pistons, connecting rods, crank shafts, or heads.

Chief Joseph powerhouse also has two reciprocating heat pumps, including many feaures of both the McNary and Detroit systems. Unlike McNary, the Chief Joseph generator-turbine room is heated by air from central air conditioners. These use warm water directly from the generator coolers. This system has kept the temperature in the generator-turbine room within acceptable limits.

But, in winter, generator water must be kept at a higher temperature than would be required with heat pumps, thus raising the generator air temperature higher than desirable.

The Dallas air-conditioning system is still being installed. Eventually, Dallas will have three 140-ton centrifugal heat pumps. A capacity measurement on the first pump installed indicates a higher efficiency than that at McNary. A device shuts off the compressor motor when the surging point is approached, as capacity requirements on the centrifugal compressor fall. Too frequent cycling of the motor is prevented by a time delay.

Before you buy another



et transformer...

ANALYZE PRICE

General Electric keeps price down with standardization, volume, product innovation

Using the period from 1935 to 1939 as the base, nonferrous metals are up 139%, iron and steel up 174%, and labor is up 234%. Yet G-E pole-type distribution transformers are now up only 59%.

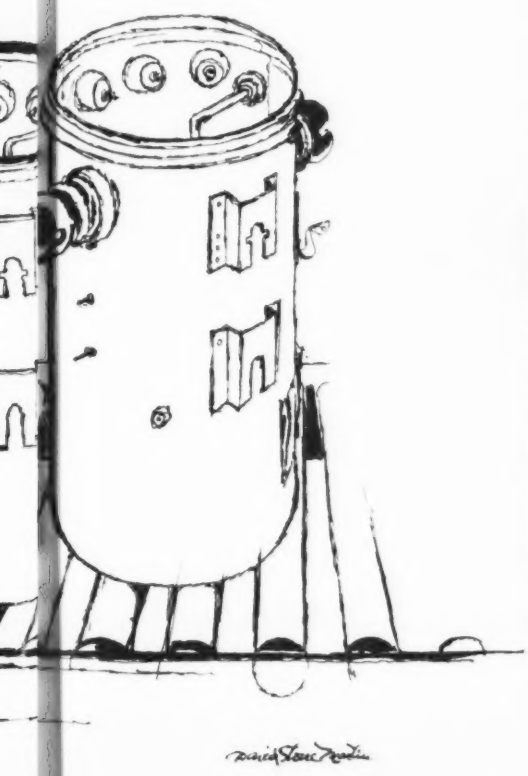
The cost of transformers remains comparatively low thanks in part to your increasing number of large-volume orders and to your support of standardization programs. Both contribute importantly to economical mass production.

Product innovations have also helped keep transformer prices down. General Electric's $1,000,000 development of grain-oriented strip steel, for example, has resulted in an estimated saving of over $300,000,000 to utilities since the steel was introduced twenty years ago.

Before you buy another distribution transformer, analyze price—give your transformer manufacturer credit for the extra values he gives you. General Electric Company, Schenectady 5, New York. 431-82

Progress Is Our Most Important Product

GENERAL ELECTRIC



GIVE YOUR TRANSFORMER MANUFACTURER CREDIT FOR THE EXTRA VALUES HE GIVES YOU		G.E.	OTHER MFRS.			
MEASURE LOAD BUILDING—do Co.'s other products build load? Does Co. sponsor load-building programs?						
CHECK SERVICE—24-hour shipment? repair and uprating? emergency assistance?						
COMPARE FEATURES—how many exclusive features in terms of longer life; reliability; easy maintenance?						
ANALYZE PRICE—does Co. hold line against inflation with significant product developments?						
EVALUATE INNOVATIONS—has Co.'s research paid off for you? Recent examples?						

FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.

Signal Lights Speed Checks

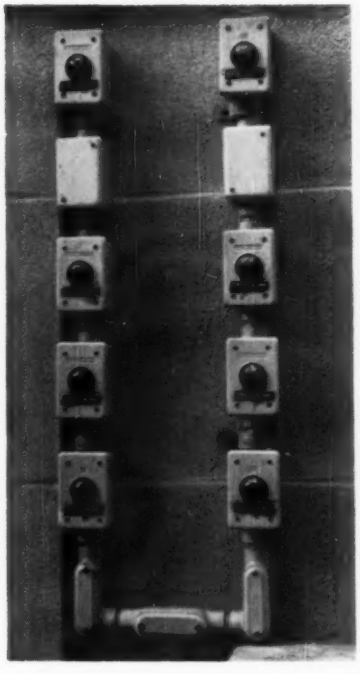
J. W. MURRAY, JR, Distribution Engineer, Southwestern Electric Power Co, Shreveport, Louisiana

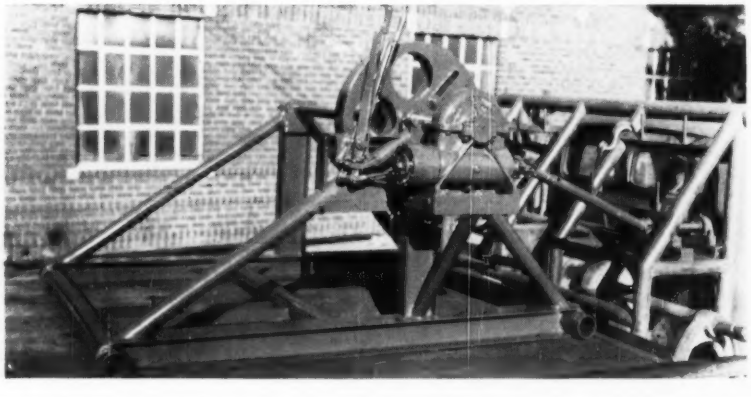
Colored signal lights make the job of checking the position of network protector switches an easier one for operating personnel of Southwestern Electric Power Co. The lights—red and green—are placed so as to be readily visible and eliminate the need to enter the vault.

Use of the signal lights follows the practice of Southwestern Electric Power crews of checking each transformer installation on a primary network circuit that has been de-energized and then re-energized. This practice was established because of the possibility of erratic operation, even though network protectors are automatic. Checking protector operation after a feeder was re-energized formerly required considerable time, chiefly because it was necessary to enter vaults.

Red and green indicating lights now are installed in the vaults at locations readily visible through the vault grates from the sidewalk. For vaults in building basements, indicating lamps are placed on building walls adjacent to an alley.

Lights consist of clear incandescent 155-v lamps with red and green plastic jewels. Lamps are operated on 125 v to increase operating life. Lights are mounted in surface-type switch boxes, with control wires running in conduit to the network protector.





Gear-Driven R

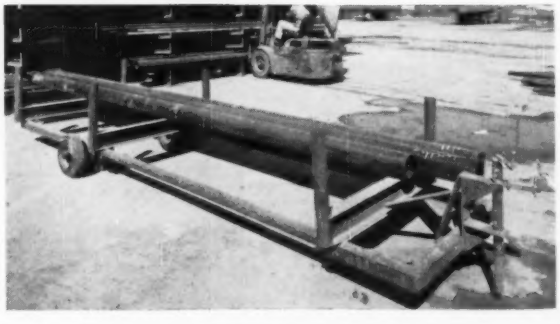
Greater safety in wire stringing and removal on Kansas Gas & Electric Co's system follows use of a take-up reel operated by a gear drive from the power take-off. The new drive was developed by KG&E's transportation supervisor, Lawrence Warren, and built in the company garage.

The new drive eliminates an old chain drive which was a hazard to men working around it.

Special Cart Handles Pipe

LAWRENCE J. COSTELLO, Stores Dept, Detroit Edison Co, Detroit, Michigan

A special heavy-duty cart handles pipe at Detroit Edison's new Warren Avenue Service Center. Formerly pipe was moved with lift trucks or on small light-weight carts. Large loads can be handled faster and more safely with the new unit, which is equipped with pneumatic tires.



"Fishy-Back" Service Delivers Poles in Trailers

LOUIS TIETELBAUM, Asst to General Supt of Distribution, Public Service Electric & Gas Co, Newark, N.J.

A 325-ft converted LST brings wood poles from Norfolk, Va., to Camden, N. J., in a "fishy-back" operation recently begun by Public Service Electric & Gas Co. Savings over other methods of delivery amount to at least $2 a pole.

The ship, which makes two round trips a week, can accommodate up to 50 trailers with their pole loads on its two decks. At Camden, tractors are attached to the trailers for hauling the poles to job sites anywhere on the Public Service system or to local pole yards. There is no rehandling and the service speeds deliveries of poles.

As delivery is on a 48-hr basis, there is no need to build up yard inventories. Poles, however, cannot exceed 50 ft. They are loaded at the producer's Norfolk location in accordance with specific Public Service orders.

Reel Offers Stringing Safety

The new drive consists of totally-enclosed gears and shafts which eliminate the problem of men getting caught in the operating mechanism.

When conductor is being paid out, the mechanism is thrown out-of-gear and the brake is used to control speed. When taking in conductor, the gear is engaged and the truck engine furnishes power for reeling-in.

Slip cones center the reel on the shaft. Use of a universal drive shaft obviates the need for the reel to be in perfect alignment. Drive pins are adjustable to fit the reel.

The mechanism can be set up quickly. It anchors to the A-Frame pockets on the truck bed. The brake band is split and hinged so that it can be opened and the shaft lifted out.

Bikes Speed Men About Plant

Detroit Edison's St. Clair plant is so large that personnel use bicycles to good advantage in getting about. The idea originated with a maintenance foreman, who received a cash award for his "work simplification" idea. Now 30 "bikes" supplied by the company are used. Trailer carts for hauling heavy tools are being considered.

Tool Scarfs Gaskets Quickly

N. J. GALUPPO, Supervisor, Transformer Maintenance, Indianapolis Power & Light Co, Indianapolis, Indiana

Ease and speed in scarfing gaskets plus better gasket joints are the result of a special scarfing tool being used in Indianapolis Power & Light Co's transformer shop. The steel tool, made in IPALCo's machine shop, is cadmium plated to prevent rusting while stored in tool trucks.

The new tool takes the guess work out of making perfect scarfed joints for a good oil seal. Angle and length of scarf can be varied by adjustments on the tool. Gasket ends do not tear when feathered out to the zero point.

SCARF ANGLE and length may be varied with tool developed by Clarence Oberting, electrician

Epoxy Insulation Cuts Motor Maintenance

Epoxy-impregnated insulation on dc traction motors is saving the Pennsylvania Railroad a half million dollars a year. PRR engineers expect that the new insulation will eliminate the cause of 75% of the electrical breakdowns in traction motors.

The material, developed by Motor Coils Mfg Co in cooperation with PRR personnel, is based on large mica splittings used in both tape and wrappers. Natural mica, in the form of large flakes, provides the highest resistance to dielectric stress over long periods. No reliance is placed on resin for dielectric strength, because it decreases as the resin ages.

Combined with the mica splittings are glass cloth for resistance to thermal aging, and an epoxy resin as the bonding agent. The epoxy resin is selected to react with the impregnating resin, producing a strong mechanical structure.

While mica splittings provide long-time dielectric strength, they must be supported mechanically to resist physical forces and sealed to prevent entry of moisture and dirt. The epoxy resin resists thermal degradation, does not shrink, crack or gas, and does not create voids or puffiness. The resin contains no solvents or diluents; all the impregnated resin is cured in place with the mica to form a hard, strong laminate.

Vacuum-pressure impregnation provides a homogeneous insulation. With conventional varnishes, a vacuum of 25 or 26 in. of mercury is generally used—limited by the vapor pressure of the solvent. At this vacuum, about 15 to 20% of the air is not removed and, when varnish is admitted, is trapped in the insulation and remains in the coil.

With the epoxy insulation, the insulated part is subjected to a vacuum of 5 mm of mercury or lower. At least 99.2% of the air in the coil is removed before the solventless resin is admitted.

Before impregnation, coils are heated to drive off traces of water and solvents used in the mica tape. After evacuation and subsequent flooding with resin, the coils are subjected to pressure.

The normally low viscosity of the resin is reduced further when coils are heated for final curing. Special means must be used to prevent runout of the resin in the insulation. These include polyester films, Teflon tape, and special pressing molds.

Impregnated armatures must be

WHY G-E UNIT-CONSTRUCTED ARRESTERS ARE THE KEY TO REAL DOLLAR SAVINGS

by E. J. ALLEN, General Electric's Supervisor of Station Equipment Sales

Substantial savings can be realized by the elimination of "complete arrester" inventories. And only unit-constructed arresters make these savings possible. Utilities who stock spare "complete arrester" poles of several ratings can reduce their inventories by stocking only appropriate ratings of the unit-constructed General Electric station-class arrester.

THREE BASIC UNITS of the Form 3K arrester, available from factory and district stocks, provide all necessary "building blocks." These single, easily-handled units can be readily added or removed to change arrester ratings. For example, when increasing a 138-kv grounded neutral system—using an "80 percent" 121-kv arrester—to a 230-kv grounded neutral system—using a "75 percent" 182-kv arrester—you need add only one 60-kv Form 3K arrester unit and grading ring.

ONLY THE G-E MAGNE-VALVE station-class arrester combines the advantage of rugged unit construction and built-in anti-contamination feature with service-proved Magne-valve electromagnetic principle of arc interruption. And, of course, modern Thyrite* station-class arresters can be "hot-washed" with hose or spray systems.

For complete details contact your G-E Representative or write Section 435-20, General Electric Company, Schenectady, N. Y.

*Reg. Trademark of the General Electric Company.

GENERAL ELECTRIC

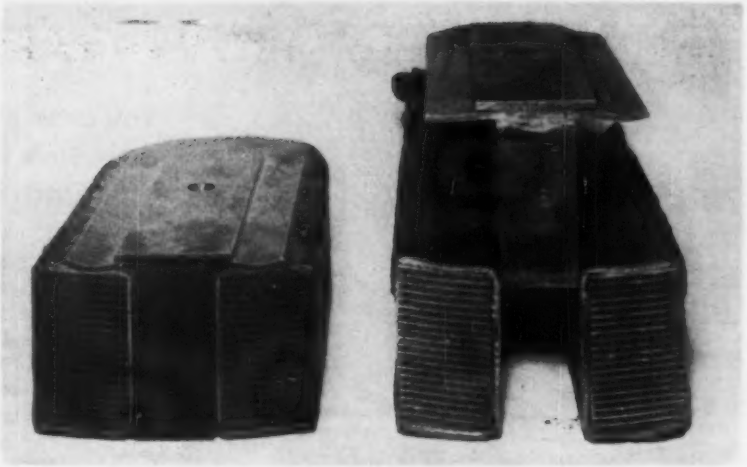
cured in rotating stands to prevent resin run-out. As the armature rotates in a horizontal position, the liquid resin distributes in an even coat over all surfaces.

To guarantee against relative movement between a field coil and its pole piece, the impregnated coils are fitted to their individual poles and cured together. On some coil designs, the insulated coil is usually loose on its pole piece. Instead of making up this space with insulating fillers, sheet copper is fitted between the coil and pole piece, then bent over the coil on the frame side. This copper shim acts as a thermal shunt which transfers some of the heat flowing from the coil directly to the frame.

The first epoxy-impregnated coils were put in service two and a half years ago. They ran a little hotter than desirable, but they proved so durable and resistant to severe service conditions that research continued. The formula was improved until the spring of 1959, when a resin was developed which adds only 3% to the operating temperature.

Meanwhile, PRR engineers pioneered new application techniques in which more and more motor components were bonded together with the epoxy, further reducing the danger from contaminants, cutting down on the possibility of vibration damage, and insuring greater service life for parts. The same insula-

(*Continued on page* 120)



INTEGRATED INSULATION (at left) requires less space than open face insulation. Copper shims for heat transfer are set next to the permanently-bonded core

nit construction of station-class lightning arresters provides economical and versatile protection

42 KV 48 KV 60 KV

Basic building units of the General Electric Form 3K station-class lightning arresters. These units are stacked to provide a variety of ratings for high- and extra-high-voltage circuits, 69-kv to 460-kv, as shown with 182-kv arrester on right for 230-kv Grounded Y system. This is but one of 15 standard ratings constructed from basic units.

GENERAL ELECTRIC

Engineers' Seminar C

Latest developments outlined at joint PEA-Penn State program; utility and manufacturing experts led discussions

ATTENDANCE CERTIFICATE was given Roger F. Roosa, right, Central Hudson Gas & Electric Corp, by Albert H. Jacobson, Associate Dean of Penn State's College of Engineering and Architecture. Professor Paul E. Shields is at left

Electric utility engineers went back to school in Pennsylvania recently. The school was a three-day seminar sponsored by the System Planning Committee of the Pennsylvania Electric Association and held on the campus of Pennsylvania State University. The professors were utility and manufacturing experts.

The purpose of the seminar was to bring engineers up to date on advances in all utility fields, as well as to identify the need and opportunities for engineers in utilities with the activities of the university. Registration was about 50, with a number of representatives from utilities other than PEA member companies.

The shirt-sleeved engineers gathered around tables to exchange opinions and questions on current problems and to listen to reports of progress in activities ranging from probability methods in system planning to future uses of electricity.

Generation, transmission and distribution progress were outlined by speakers, and attention was given to developments still on the drawing boards. Other subjects covered included the use of computers on utility

HOW RELIABILITY IS BUILT INTO THE MAGNE-VALVE ARRESTER

by R.W. FRAHM—Manager of Lightning Arrester and Cutout Marketing

Every General Electric Magne-valve arrester is subjected to exacting factory tests to assure high mechanical and electrical strength.

Each Thyrite* valve element disk receives multiple impulse discharges to stabilize and measure its discharge voltage characteristics. Each assembled unit receives a production line 60-cycle sparkover test and a test to assure freedom from radio noise. A vacuum test ascertains the arrester housing's ability to seal out atmospheric moisture. Thus, each functional element of the arrester is separately checked. Units which fail to measure up in any area are immediately rejected.

Field experience has proven that these tests provide you with the best distribution arrester available. Since 1953, when General Electric introduced the first magnetic gap controlled distribution arrester, 1,300,000 arrester years of near-faultless service have been compiled—substantial evidence that quality and reliability are built-in features of every G-E Magne-valve arrester.

We'd like to tell you more about our complete line of distribution arresters. Contact your General Electric representative or write Section 435-21, General Electric Co., Schenectady, N. Y.

*Registered trademark of General Electric Co.

GENERAL ELECTRIC

Exacting factory tests assure th

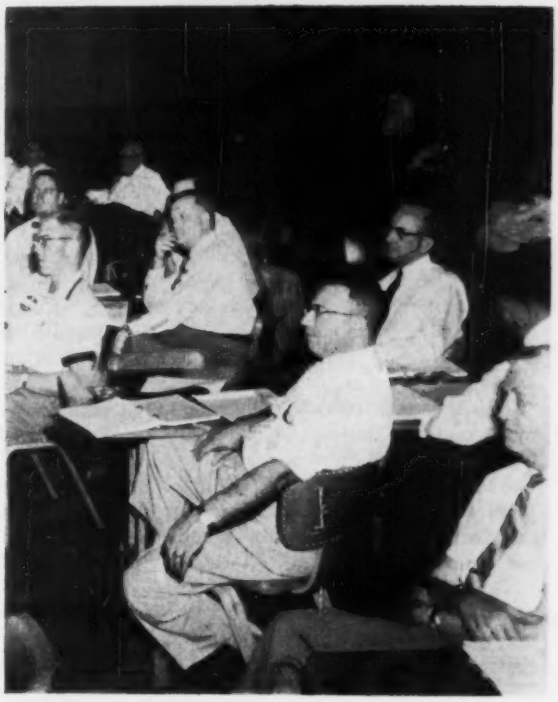
Covers New Advances in Utility Fields

systems, system planning principles, utility research and development, electronic applications and allied fields in utility work.

Speakers included W. N. Terry, Jr, Allis-Chalmers Mfg Co; J. A. TenBrook and E. E. Brown, Philadelphia Electric Co; W. G. Dempler, Duquesne Light Co; H. D. Limmer, Public Service Electric and Gas Co; F. J. Maginniss, General Electric Co; W. H. Osterle and J. H. Westbrook, West Penn Power Co; B. L. Lloyd, D. N. Reps and C. H. Rice, Westinghouse Electric Corp; and W. S. Kleinbach, Pennsylvania-New Jersey-Maryland Interconnection.

Each participant in the seminar received a notebook for use during the sessions and was awarded a certificate of attendance. Moderator for the seminar was Willard U. Baum, Pennsylvania Power & Light Co. Arrangements were coordinated by Paul E. Shields, professor of electrical engineering, Pennsylvania State University.

The program was also open to Penn State engineering students. Several of those attending expressed surprise at the wide range of utility opportunities open.



INFORMAL ATMOSPHERE helped increase audience participation in discussions of common industry problems

re the reliability of General Electric

Magne-valve distribution arresters

GENERAL ELECTRIC

Opponents Score PUD Plan To Acquire Local Facilities

Despite protests at an Oct. 7 hearing, Thurston County PUD reaffirmed its plans to acquire facilities of Puget Sound Power & Light Co within the county.

Opponents of the plan said proper notice wasn't given for an Oct. 5 session at which PUD commissioners approved a 2-mill tax to raise $100,000 for preliminary engineering and legal costs. The press had not been notified and previous minutes gave no indication the Oct. 5 meeting was to be held, the objectors said.

Frank Meyer, commission chairman, said the decision to proceed with the acquisition was made too late to give earlier notice. A year's delay would have been necessary if the Oct. 5 action had not taken place, he said.

Opponents argued that taxpayers of the county should be able to vote on the proposed acquisition and that removal of Puget Power properties from the tax rolls would cost the county residents at least $62,000 a year.

New Spirit of Cooperation Evolving on Atomic Power

One result of Premier Khrushchev's visit to the U. S. may be new cooperation between the Soviet Union and the U. S. on atomic energy.

John A. McCone, Atomic Energy Commission chairman, met twice with his Russian counterpart, V. S. Emelyanov, during the celebrated visit.

AEC declined to provide details, but announced that the talks "have been very useful as a preliminary examination of means of cooperation . . . and [to] reaffirm their belief that such cooperation should be under the aegis of the International Atomic Energy Agency."

The IAEA, which has been foundering for the lack of concrete work to do, obviously welcomes the apparent new spirit of cooperation. The talks embraced the prospects for exchanging scientists in controlled nuclear research and, presumably, exchanging information through the IAEA for the benefit of underdeveloped nations.

Utility Relocation Cost Ruled Illegal in Idaho

State funds cannot be used to reimburse utilities for the cost of relocating facilities as a result of new highway construction, the Idaho Supreme Court has ruled. It said a 1957 law requiring such payments was unconstitutional.

The court's 4-to-1 opinion said, "The right of utilities to the use of public thoroughfares is not and cannot be regarded as a permanent property right."

The ruling said the 1957 law sanctioned lending the credit of the state for a private purpose and constituted a gift of public money to the utilities. The case involved Idaho Power Co and Mountain State Tel & Tel Co.

WHY G-E FUSE LINKS GIVE MAXIMUM SYSTEM PROTECTION

By D. L. McINTIRE—Lightning Arrester and Cutout Product Planning Specialist

General Electric universal fuse links give you maximum overcurrent protection on distribution systems. Designed for use in every type of cutout, these fuse links are available in fast (K), slow (T), EEI-NEMA Types from one to 100 amperes, and high-surge links up to eight amperes. Ratings of 140 and 200 amperes are available in the solid-head type only.

General Electric universal fuse links offer you these important advantages:

Premature melting is eliminated by silver plating threaded parts to maintain low contact resistance.

Efficient low-current operation is assured by the bonding process and a specially prepared paper in the auxiliary tube.

Fuse withstands continuous overcurrents. General Electric EEI-NEMA fuse links will withstand continuous overcurrents of approximately 150 percent of rating.

Instant separation is assured by new internal spring that prevents cable fouling inside the auxiliary fuse tube.

Drop-out interference is eliminated by the use of a flexible cable. Fine-stranded cable can be used since the G-E fuse element has excellent temperature control.

Like more details? Contact your G-E Sales Engineer today, or write to Sect. 435-23, General Electric Co., Schenectady, N.Y.

GENERAL ELECTRIC

PG&E Wheeling Contract Ok'd by Interior Dept

The Interior Dept has approved new contracts with Pacific Gas & Electric Co to wheel and firm up 450 Mw annually to preference customers in California from the federal Central Valley Project.

The contracts expire April 1, 1971, and provide for increased wheeling capacity if and when additional federal plants—such as Trinity Dam— are built.

Sen Clair Engle (D-Calif.) had requested that wheeling rates be reduced below one mill, a 500-Mw wheeling capacity set, and that the wheeling service area be extended into San Francisco. None of his suggestions were included.

Rate Refund Sought

The Maryland Public Service Commission has been asked to order Baltimore Gas & Electric Co to refund $2,223,170 to its customers. Wilfred T. McQuaid, people's counsel, in a petition claimed the utility earned that much more than it was authorized in a rate schedule approved last July.

In its last quarterly statement, BG&E reported a net income of $15,079,000 for eight months ending Aug. 31 vs $12,138,000 for the corresponding period in 1958. The company "will vigorously oppose the petition" for a refund, said Pres J. T. Wolfe.

Indiana PSC Probe Set

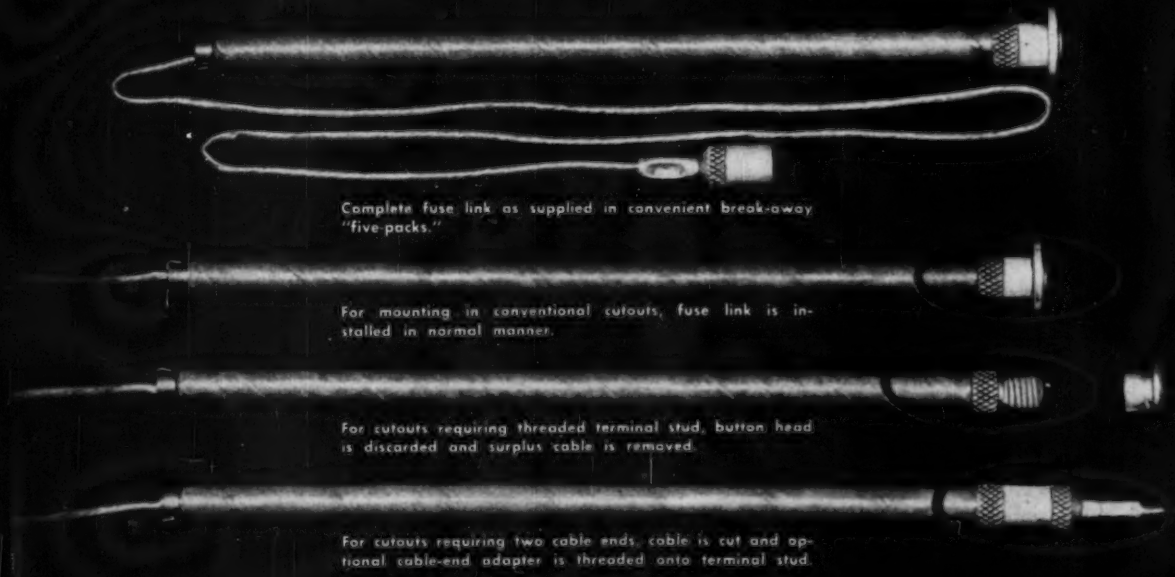
An investigation of Indiana's Public Service Commission has been authorized by a state legislative advisory commission. The study will look into the PSC's operations, its enforcement of utility laws, hearing procedures and the possibility of a staff merit system.

Rep Paul E. Pierce of Indianapolis recommended the probe. He said that the PSC was created to strike a balance between reasonable profits for utility owners and best rates for the customers.

Safety Film Available On Pole-Top Protection

A $30 black-and-white 35-mm sound slide film called "Pole Top Pals" is now available, the Edison Electric Institute's Accident Prevention Committee has announced. The 19-minute movie emphasizes how linemen should establish a protection zone by use of rubber goods.

re nterrupted quickly—effectively, by
General Electric universal fuse links


Complete fuse link as supplied in convenient break-away "five-packs."
For mounting in conventional cutouts, fuse link is installed in normal manner.
For cutouts requiring threaded terminal stud, button head is discarded and surplus cable is removed.
For cutouts requiring two cable ends, cable is cut and optional cable-end adapter is threaded onto terminal stud.

GENERAL ELECTRIC

Procurement & Products

OUTLOOK ▶ **Best chance to prevent a serious business recession in 1961,** warns McGraw-Hill's Department of Economics, is for businessmen themselves to act sensibly in 1960. They should recognize that the steel shortage is temporary, that once this bottleneck is broken there will be ample supplies of durable goods generally, and that moves to increase inventories or plant capacity on the basis of the next few months' sales figures may prove extremely unwise and costly.

A little price restraint on the part of sellers and price resistance from purchasers, continues the Economics Department, would also be a big help in keeping business on an even keel.

Steel strike has now continued so long that making up its losses will involve surging business activity up to, and perhaps well beyond, the middle of next year. This could very likely bring price increases wherever the scrambling gets too eager.

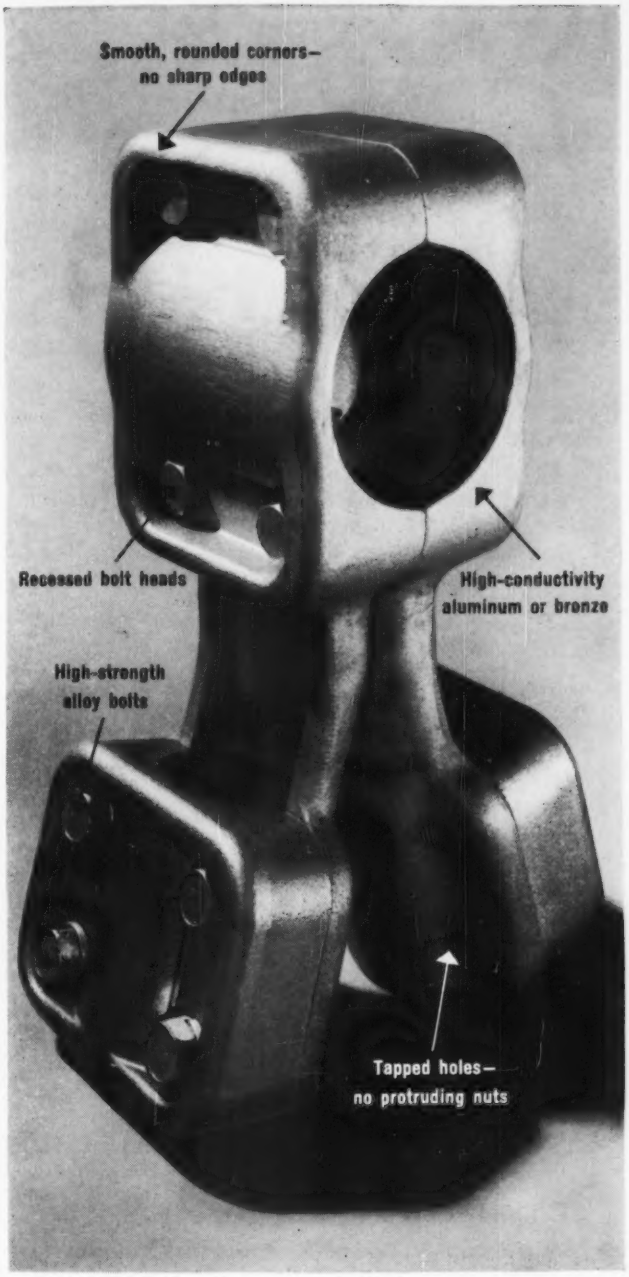
STORES ▶ **Central stores operation will be ready to go about January** at Connecticut Light and Power Co. Plan has been worked out for using the utility's 7070 computer with the warehouse as soon as the computer is available. Only one piece of paper will be used from requisitioning to the accounting. Punch cards will be used eventually.

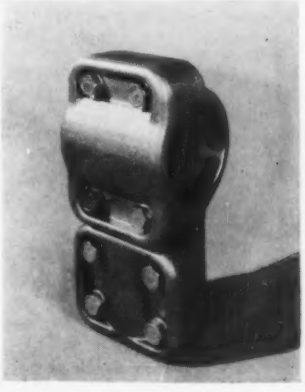
SALVAGE ▶ **Centralized salvage department has been set up** by Public Service Co of Colorado to handle the collection and sales of all scrap from other departments. Formerly some of the departments handled their own salvage operations. Other departments sent every batch of scrap to the salvage department, making out individual reports for each batch. Now these departments may accumulate scrap until a sizeable quantity can be turned over at one time. This will save considerable paper work in the salvage operation.

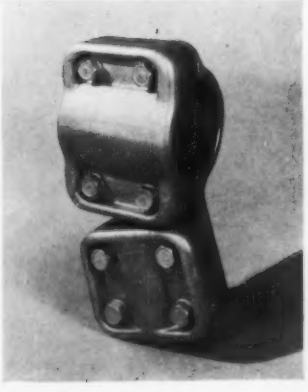
ALUMINUM ▶ **Price reductions of 15% on aluminum sheet by** the large primary producers bring cries from the independent fabricators, reports Engineering and Mining Journals weekly market newsletter. The independents say the cut makes business impossible for them and they predict it will cut into the profits of the major producers also. Main purpose of the reduction, said one large primary producer, was to compete with galvanized steel.

RESEARCH ▶ **Process for construction of large objects from tungsten** and other strong high-temperature metals and alloys has been developed by Westinghouse Electric Corp. It is known as a continuous powder compaction process.

News of Manufacturers ..... page 78
New Equipment ..... page 92
Readers Service ..... page 98







NEW Delta-Star CORONA-FREE E.H.V. CONNECTORS

These new Delta-Star "CORONA-FREE" connectors were designed for the increasing number of extra-high-voltage systems where corona loss becomes a problem.

These new generously-proportioned aluminum alloy or bronze connectors are designed to have no sharp corners or protruding bolt heads. Clamping bolts mate with tapped holes, eliminating another possible source of corona—the external nuts.

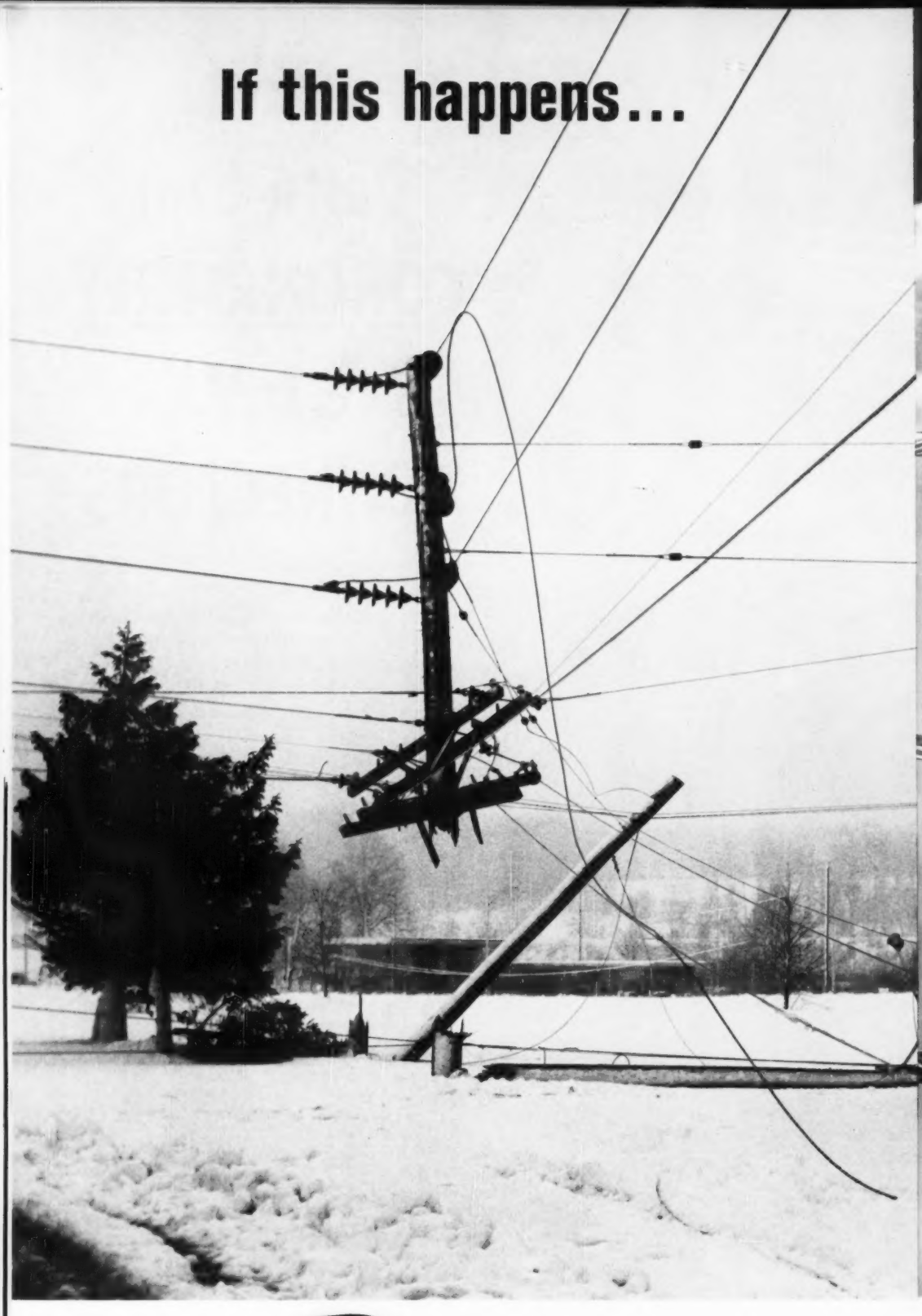
New Delta-Star aluminum *CORONA-FREE* Connectors are packaged in polyethylene at the factory to prevent oxidation up to the point of installation. Instructions on latest installation method included with each connector. Now available in several sizes and types. For further information, write to *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Illinois.*

DELTA-STAR PORTER ELECTRIC DIVISION

H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; PEERLESS ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

If this happens...



You can look up to **Preformed**™

FOR FAST, EMERGENCY SHIPMENTS

Call Cleveland, EXpress 1-3571
or wire "Preformed Cleveland"

For fast, simple, tool-free PERMANENT Repair and Maintenance use *Preformed*™

ARMOR SPLICES

Winter aggravates concentrated clamp stresses at suspension points. Repair existing damage before Winter hits; and guard against future damage from arc over and vibration.

LINE SPLICES

You get line failures when temperature cycling and icing loosen chuck jaws or bolted fittings. Make a fast, sure connection by repairing with Preformed Flexible Splices . . . always compatible with the conductor.

PATCH RODS

Rapid repair of damage to conductors (not exceeding 25% of the outer layer of cable) is best accomplished with Preformed Patch Rods which will restore full mechanical strength and electrical conductivity.

Patented — U.S. Patent No. 2,409,653; other P[illegible]

SPLICE SHUNTS

When moisture pockets cause internal corrosion and overheating, failure of the joints may result. To restore full electrical conductivity and mechanical strength, wrap on a Preformed Splice Shunt over the malfunctioning splice.

PREFORMED LINE PRODUCTS COMPANY
DEPT. SP-3
5349 St. Clair Avenue, Cleveland 3, Ohio

Allis-Chalmers Shows Fuel Cell-Powered Tractor

One of the potential uses of electric power from fuel cell was demonstrated recently by Allis-Chalmers when a tractor (left) was put through its paces, powered by cells still in the laboratory-stage of development.

In the tractor, A-C uses 1008 of these cells, which, operating on a mixture of gases, largely propane, deliver a total electrical output of 15 kw. A standard 20-hp dc motor drives the 5270-lb tractor to provide 3000-lbs pull at the draw bar. Each fuel cell is ¼-in. thick and 12-in. square, with a no-load output of 1 v.

Efficiency of the present fuel cells is 60%, A-C says, but they look forward to efficiencies of 80% and compare it with the conventional heat engine figure of about 40%. While A-C has no commercial plans right now with regard to these cells, they do foresee the time when fuel cells could be used in central stations to provide peaking power. Gases used as fuel would be generated during off-peak hours by reversing the cell cycle.

So Cal Edison Gets Enamel-Coated Pipes

Huge 13-foot diameter steel pipe is shown (right) at Kaiser Steel's Napa, Calif., plant before shipment to Southern California Edison's new Mammoth Pool generating station near Fresno. The pipe, which will carry 50,000,000 gallons of water hourly to the station's turbines, has a shiny inner coating of Koppers coal-tar enamel.

The enamel is applied by a unique large-scale application of centrifugal casting. The pipe is whirled at about 22 rpm while enamel heated to 490F is spilled into it at a regulated rate. As the enamel cools it adheres to the pipe.

Purpose of the enamel is to prevent corrosion and, at the same time, provide a glass-like surface allowing swifter flow of the water. Fifty-seven sections of these 30-foot long pipes are being used in the project.

"Operation Sunrise" on Schedule, GE Says

"Operation Sunrise," General Electric's boiling water reactor development program, is moving along "on schedule," according to George White, general manager of the company's atomic power equipment department. But GE's other atomic power development program, "Operation Knowhow," which is centered around small, standardized nuclear plants to educate utility personnel and accelerate public understanding, has not received "the anticipated acceptance, primarily because of the economics involved."

These remarks were made at a press seminar held by GE designed to review the company's progress in atomic power. While there was some indication that "Operation Knowhow" was being shelved, the company stressed that it was pressing ahead on the boiling water reactor concept. Negotiations are now in progress with two groups to build two more advanced BWR's, GE said. These negotiations are expected to be completed successfully within the next 9 to 12 months.

J. Emmett Maider, APED's marketing manager, told the press group that there were five general marketing problems to be solved. These were:

- Greater economic cooperation between manufacturers and utilities. This includes a sharing by the utilities of the research and development costs.
- More lead time in laying out utility plans for nuclear plants.
- In the overseas market, a solution of the liability problem.
- Greater public acceptance of

(*Continued on page* 82)

This is only half as good

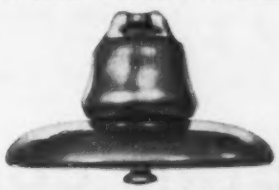
AS THE INSULATORS WE MAKE

. . . but this bisected insulator gives you a look at some of the reasons why the suspensions you buy from Chance do their job so well.

You can see how the shape of the cap and pin wedge against cement which firmly grips sand bands that are "kiln welded" to the porcelain body. You can see the heavy asphalt coating above the porcelain, on the pin, and under the cap which adds to this shock resistance. (It protects against pin corrosion, too.)

There's a lot of quality here which you can't see, however. You can't see the extreme density of the porcelain, or its built-in stability. Only a well-trained lab technician could check the cement, and know that it is of the right consistency, properly cured. Yet, these things do more to determine the quality of an insulator than the things the eye can see.

One more, most important, thing you can't see: the strict manufacturing precision and control that makes every Chance suspension an exact copy of the proven master design. Of course, you *could* see this in the plant where Chance insulators are made; it's our way of making sure our insulators will give you years and years of excellent service. We stake our reputation on it.



Chance 25,000 pound insulators wear the new NEMA Gray Glaze for easy identification. This is important to your hot-stick crews as you can use easy-to-work ball and socket suspensions without the risk of mixing 25,000 pound with 15,000 pound insulators.

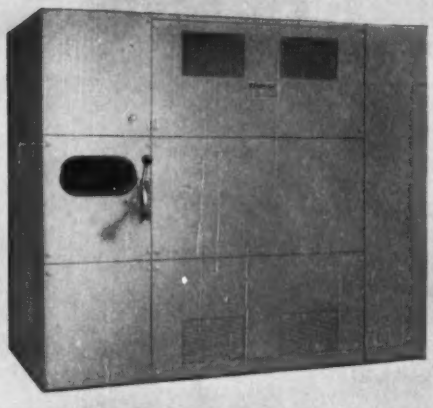
A. B. CHANCE COMPANY CI 59-25

GENERAL OFFICES: CENTRALIA, MO. / A. B. CHANCE CO. OF CANADA, LTD., TORONTO

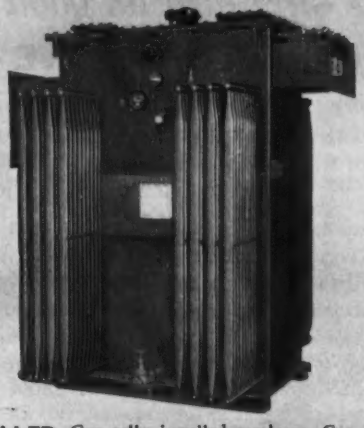
Wagner

UNIT SUBSTATION TRANSFORMERS

112½ to 2000 Kva—three phase, 60 cycles, 15 KV and below



VENTILATED DRY-TYPE—For indoor installation in reasonably dry, dust-free, well ventilated locations. Light in weight, ideal for multi-story buildings. No fire-proof vaults required. Insulated for 80°C temperature rise.

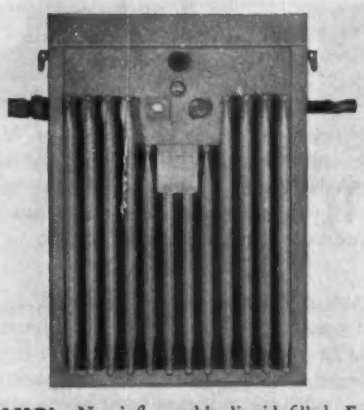


OIL-FILLED—Generally installed outdoors. Can be used indoors in fire-proof vaults. Outdoor transformers can be connected to indoor switchgear using weather-proof bus-duct. 55°C rise, self-cooled or forced-air cooled.

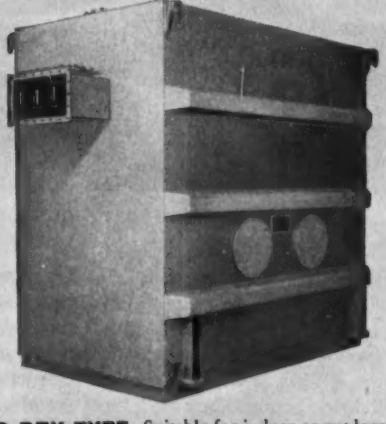
When you select a Wagner Transformer...

YOU GET THE TYPE FOR YOUR PLANT

PLUS... the assurance of continuous,



NOFLAMOL—Non-inflammable liquid filled. For indoor or outdoor installation, especially suited for chemical plants, refineries and similar locations where explosive liquids or gases are present. The close-coupled design illustrated fits flush against switchgear enclosures. Throat connected designs are also available. 55°C rise, self-cooled or forced-air cooled.



SEALED DRY-TYPE—Suitable for indoor or outdoor use, completely fire-proof, easy to clean and maintain. Sealed tank is filled with nitrogen under low pressure. Insulated for 150°C rise, self-cooled.

WAGNER ELECTRIC CORPORATION

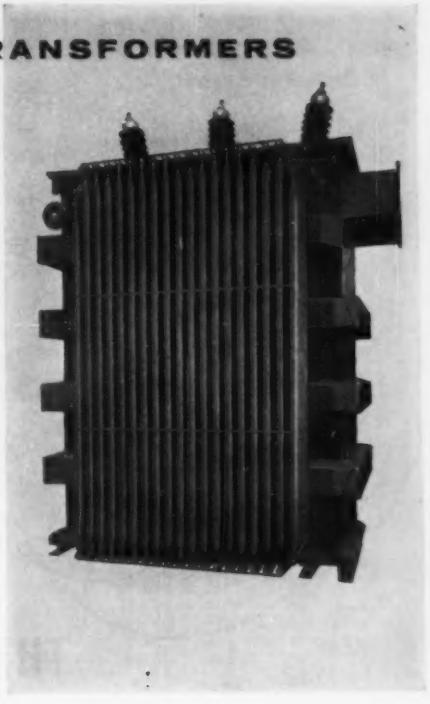
WT58-16

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

Wagner **INDUSTRIAL POWER TRANSFORMERS**

Oil-filled, through 10,000 Kva, 67 KV and below.

Noflamol, through 7,500 Kva, 15 KV and below.



If you are planning a new plant distribution system... modernizing your present one... or adding to its capacity to meet increasing demands for power... it will pay you to specify Wagner Transformers.

For your main plant substation, Wagner Liquid Filled Industrial Power Transformers are available in standardized ratings through 10,000 Kva.

For your load centers, Wagner can supply Unit Substation Transformers in any of the types shown at the left, furnished with suitable incoming line sections, to meet your particular requirements. These PREDESIGNED transformers will save you time and save you job engineering costs. You can specify the secondary switchgear you prefer.

BEST SUITED ELECTRICAL SYSTEM...

dependable service!

For plant areas requiring 120/240 volts, single-phase or 208Y/120 volts three-phase, Wagner Dry-Type Distribution Transformers are an economical choice.

All Wagner Industrial Transformers are liberally designed, sturdily constructed, thoroughly tested and able to meet the heaviest industrial demands. They assure continuous, dependable power for years to come.

For expert advice on your present and future plant transformer needs, call or write the Wagner branch near you.

Wagner Electric Corporation
6456 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner **DRY-TYPE DISTRIBUTION TRANSFORMERS**

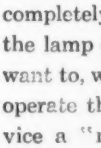
Single-phase 1 to 100 Kva—Three-phase 3 to 300 Kva—600 volts and below

Type AE, single-phase, 1 through 50 Kva, and Type AP, three-phase, 3 through 30 Kva, can be used for indoor or outdoor installation, larger ratings for indoor installations only. Ratings through 10 Kva single-phase and 30 Kva three-phase are designed for wall mounting, other ratings for floor or platform mountings.

Available for high voltages of 120 X 240, 240 X 480, 480 and 600 volts to 120/240 volts single-phase, and 480 and 600 volts to 208Y/120 volts three-phase.

TRY THIS ON THE SALES DEPT.

That fez is an automatic light switch with a circuit not unlike the Fisher-Pierce 6600A streetlighting control — tubeless, CdS cell, relay. But this "Nitelighter®" is for indoor use, to sit near a window and turn on a lamp or two (up to 300 watts total) when it gets dark or dreary outside. Although turn-on and turn-off are completely automatic, you can switch the lamp on and off yourself if you want to, with two push buttons that operate the relays and give the device a "memory." That way you don't have to remember which button you pushed last — the lamp always automatically goes back to its on-at-dusk, off-at-dawn routine.



If the name "Nitelighter" sounds familiar, you're thinking of the daddy of this brand new one. Though nowhere near as smart as this one, it sold by the thousands in stores and retail outlets of utilities. People bought them for lots of reasons — just plain gadget appeal, to fool burglars into thinking they were home when they weren't, and simply because they disliked coming home to a pitch-black house at night. As a matter of fact, we've used the Nitelighter extensively in getting the bugs out of the original 6600 photoelectric streetlighting control design and for testing various types of photocells (about 5 or 6 years ago).

Judging by the reception the first Nitelighter got, we're hoping that demand for the new one ($17.95 list) will keep us hopping. The man in charge is Frank Mead, and he'd like nothing better than to tell your sales dept. all about it. Write him at The Fisher-Pierce Co., 82 Pearl Street, So. Braintree 85, Massachusetts.

FP

FISHER PIERCE

PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

GE Atom Progress

(*Continued from page* 78)

atomic power plants. This must be fostered by a program of public education implemented by utilities and industry.

• More realistic and equitable procedures in computing and claiming the economics of various reactor systems.

Other members of GE's staff speaking at the seminar were: Francis K. McCune, vice president for atomic business development; Dr. Lyman R. Fink, general manager of the atomic products division; Dr. R. B. Richards, APED's engineering manager, and N. M. Ogle of APED's advanced engineering operation.

H. K. Porter Acquires Hill Transformer Co.

H. K. Porter of Pittsburgh has bought the Hill Transformer Company of San Carlos, California. Hill will continue to operate with the same name but as a wholly-owned subsidiary of Porter. Max Hill will continue as general manager. Porter purchased all stock and took over all assets and liabilities. The price will not be agreed upon between the companies until a final accounting at a later date. The Hill transformer line will supplement the line of Porter's Delta Star division. Dollar sales of Hill in 1958 were approximately one and one-quarter million.

Simplex Wire & Cable Builds New Test Center

Simplex Wire & Cable of Cambridge, Mass., is building a new electrical testing department for checking extra-high-voltage cable. The new concrete-block building housing the test equipment is expected to be ready by 1960.

Principal work will be testing full lengths of cable on one of the company's large reels, but laboratory tests on sample lengths will also be included.

Dc testing equipment includes a GE rectifier capable of producing

(*Continued on page* 86)

Traffic Cops that never sleep...

VICTOR Apparatus Insulators

Sub-station switches are comparable to traffic cops. They are designed to keep power (traffic) moving from generating stations to consumers without interruption or confusion. Their ability to perform the necessary switching operations, instantly, reliably, is dependent on apparatus insulators used in their assembly.

VICTOR No. 729
Apparatus Insulator
(EEI-NEMA 58-7)

"THE PEOPLE'S CHOICE"

VICTOR Apparatus Insulators are the universal choice of power men . . . for several very important reasons. Proven design, quality controlled manufacture and conscientious testing have given them an enviable reputation for reliability under extreme conditions of service. These insulators have mechanical and electrical test values far above EEI-NEMA standards. They are premium grade insulators, designed and made to do the job better, longer, more dependably than any other apparatus insulator made. You just can't buy better stacking units—at *any* price!

WELL PUT TOGETHER

Yes sir! When you put VICTOR Apparatus Insulators in your sub-station, you've got insulators that won't let go even under rigorous switching service. Made of Purified Porcelain, scientifically fitted with highest quality glaze, the shells together with cap and pin are assembled with premium grade insulator cement in tempered cast-iron jigs. VICTOR Apparatus units are not only put together right . . . they *stay* put together. And their jig assembly results in completely accurate alignment for easy, speedy stacking.

BLACK LIGHT

Soundness of insulator porcelain is of utmost importance to every power man. Imperfections, too small for detection by eye alone, can cause costly failure and interruption of service. We certify the soundness of our larger shells by the use of black light. Before glazing we spray them with a fluorescent material, then bathe them in ultra-violet light. This process detects the slightest imperfection. Shells found imperfect are discarded. This procedure assures you of perfect insulators, cuts costs, minimizes replacements, safeguards service.

WE MAKE OUR OWN RAIN

One of the big advantages of choosing a VICTOR insulator is the knowledge that the EEI-NEMA ratings published in the VICTOR catalog are minimum. Fact is, every VICTOR unit has an in-built reserve that permits it to operate at or above these ratings. We know it because our laboratory tests have proved it. Take wet flashover, for example. We subject our insulators to artificial rain sprayed through a scientifically designed nozzle while 60-cycle current is applied in gradually increased voltage steps until flashover occurs. Water is of controlled resistivity, volume and direction. This is why you get wet weather protection "above and beyond the call of duty" —with VICTOR.

LIGHTNING . . . MADE TO ORDER

In order to really know how an insulator will withstand the effects of lightning, we make our own. VICTOR's electrical laboratory is equipped with an impulse generator that throws a lightning bolt at an insulator under test. This modern unit is equipped with a remote controlled gap spacing mechanism, an oscilloscope for showing wave forms visibly on the screen of a cathode ray tube and a 4" x 5" camera for recording these waves on film for observation and study. One more reason why VICTOR gives you insulators that last . . . that are design-tested to withstand lightning and other adverse service conditions.

For full information on VICTOR Apparatus Insulators write I-T-E Circuit Breaker Company, Victor Insulators Division, Victor, N.Y.

I-T-E CIRCUIT BREAKER COMPANY
VICTOR INSULATORS DIVISION

AS TULANE GROWS...

G&W PROVIDES ECONOMICAL M

Campus scene—Tulane University

New main substation consists of two G&W Uniclad units. The large unit is the power center which houses a 15 kv, 400 ampere sectionalizing load break oil switch and eight three-phase power fuse taps. Facing it at left is the metering unit which houses a 15 kv, 400 ampere dual feeder load break oil switch and metering compartment.

Please send me your folder on the Tulane University installation.

Name_____

Position_____

Company_____

Address_____

City_____ Zone_____ State_____

FREE FOLDER tells how Tulane achieved flexibility and economy in its new electrical distribution system. Contains informative data for future reference.

SEND FOR IT TODAY!

Contributing to this project were G&W representative, W. P. Dillon; Director of Physical Plant Maintenance at Tulane, G. Johnson; consultants were W. King and R. C. Morgan IV of Design Engineers and Associates; I. Isaacson, Jr. of Weil and Moses; A. Pincus of Mario Zervigon and Associates and Joseph E. Leininger and Associates. The electrical contractors were Lindsey and Morgan, Gibson and Odom, Busy Electric, and Nola Electric.

G&W "RAL" sectionalizing switch installed in transformer vault. Loop feeders go to the switch to serve the load transformer. Feeders, switch, or load can be isolated without affecting the remainder of system. Shown are William King, design engineer (left), and George Johnson, Director of Physical Plant Maintenance, Tulane.

MEANS OF EXPANDING

an underground distribution system

When Tulane University's rapid growth created a need for expanding the existing 2400 volt electrical distribution system to a 13,800 volt loop system, G&W equipment scored a new high for flexibility, economy and dependability.

Versatile G&W equipment provides a simple, comparatively low-cost means of isolating load and circuit faults in any part of the system to avoid excessive outages.

G&W switches, fuse cutouts and Uniclads (metalclad switchgear) offer worthwhile savings. Made of standardized components, they are engineered to meet the exact requirements of the job. Assembly is simplified. Result: unexcelled distribution system economy!

G&W equipment offers many other significant advantages. Our new Tulane University folder gives the full story . . . be sure to send for it today.

George Johnson of Tulane (left) and Alan Pincus, consulting engineer, check a G&W Load Break Oil Switch-Fuse Unit under the Tulane stadium.

G&W ELECTRIC SPECIALTY CO.
3500 W. 127th St., Blue Island, Ill.
Canadian Mfr.—Powerlite Devices, Ltd.
Toronto, Montreal & Vancouver

For street lighting . . . from 120 V multiple to 10,000 V series . . .

use cost-saving SUPERIOR CABLES

Thermoplastic Series Lighting Cables

- High resistance to earth acids and alkalis
- High resistance to sunlight, moisture, weather
- Small diameter, lightweight
- Easy to splice

Figure 8 Pole and Bracket Cable

- High resistance to abrasion, mechanical damage
- Does not deteriorate with age or weather
- Will not support combustion
- Flexible, strips clean, speeds installation

SUPERIOR CABLES are quality-engineered, precision manufactured and thoroughly tested.

With these plastic insulated and jacketed cables, performance and economy go hand in hand.

For low initial cost . . . for less maintenance cost . . . order SUPERIOR CABLES!

For complete information and prices, write

SUPERIOR CABLES

SUPERIOR CABLE CORPORATION

Hickory, North Carolina

3765

Simplex Test Center

(*Continued from page* 82)

500 kv and 25 ma. Later, the rating may be extended to a million volts.

Ac testing equipment, to be made by Westinghouse, will provide 200 kv at 20 amp. This will be produced by a 900-kva, single phase generator, driven by a 400-hp motor. Output of the generator will be fed through a 4000-kva transformer.

Panama Canal to Light Around-the-Clock Traffic

Around-the-clock use of the Panama Canal will begin next spring as the result of the installation of 1300 fluorescent luminaires to illuminate the Canal's three locks. General Electric is supplying the units under a $500,000 contract. Except in emergencies, ship traffic through the Canal has in the past been limited to daylight hours.

A-Power Plant Model Available to Hobbyists

A hobby kit that can be assembled into a cut-away model (shown above) of an atomic power plant similar to Yankee Atomic's, is Westinghouse's latest venture into the atomic power field. Revell, Inc is marketing the model; Westinghouse provided the "technical know-how." Price: $6.95

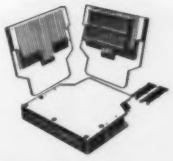
(*Manufacturers Literature, p* 89)

Here's the inside story of industry's

MOST RUGGED HIGH VOLTAGE SWITCH

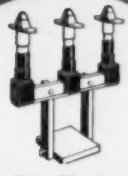
THIS SOLENOID AIR BREAK CONTACTOR IS THE HEART OF THE A-B STARTER LINE

A tremendous operating life has been built into these new A-B high voltage, air break starters by using the same simple solenoid design—with only ONE moving part—that has proved good for millions of trouble free operations in Allen-Bradley low voltage starters. A-B high voltage starters are made for all types of service and for all types of motors up to 1500 hp, 2300 v; 2500 hp, 4600 v. Send for Publication 6080, today.

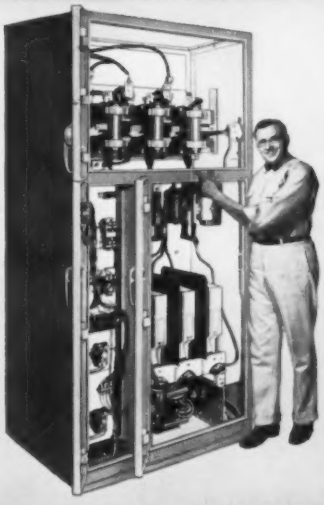


Faster Arc Suppression
New blowout design. Novel arc chutes are molded from an arc resistant material.

Double Break Contacts
Silver alloy contacts never need maintenance. Vertical motion assures uniform contact pressures.



Only One Moving Part
Simple solenoid design eliminates trouble-causing pins, pivots, and flexible jumpers.



A-B High Voltage Starter with Air Break Contactor

Bulletin 1159 high voltage air break, across-the-line induction motor starter in NEMA Type 1 enclosure. All Allen-Bradley high voltage starters are equipped with current limiting fuses with interrupting capacities of 150,000 kva at 2300 v; 250,000 kva at 4600 v.

ALLEN-BRADLEY

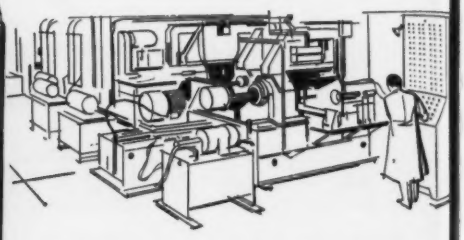
Member of NEMA

Quality Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

AUTOMATION BEGINS HERE

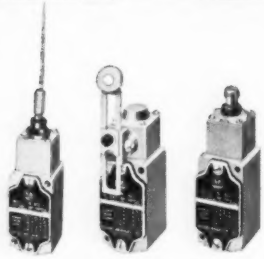
... Insist on Allen-Bradley accessories for continuous automatic production



In this broad line of Allen-Bradley accessories, each and every unit carries the traditional A-B trademark of *quality* that stands for trouble free operation. Rugged construction, and maintenance free, silver alloy contacts provide the reliability that is essential to the continuous operation of *your* automatic production machines.

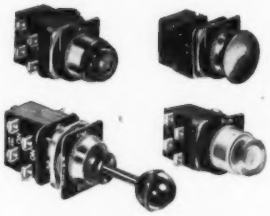
Profit from the experience of the leading machine tool builders . . . insist on Allen-Bradley *quality* motor control *all the way!*

▲ Special push button panels can be assembled to your specifications.

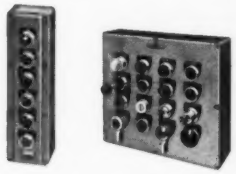


OILTIGHT LIMIT SWITCHES
Bulletin 802T with sealed heads and bodies. Various operators.

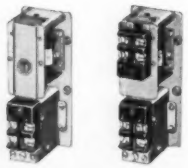
PRECISION LIMIT SWITCH
Bulletin 802 oiltight. Responds to very small operator travel.



OILTIGHT CONTROL UNITS
Bulletin 800T. Choice of push buttons, lights, and switches.



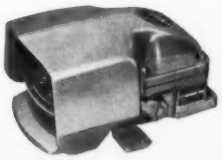
OILTIGHT CONTROL STATIONS
Bulletin 800T for up to 16 units in die cast aluminum enclosure.



PNEUMATIC TIMERS
Bulletin 849. Reliable and accurate. For on-delay or off-delay.

OILTIGHT PRESSURE CONTROL
Bulletin 836. For hydraulic systems with pressures to 5000 psi.

STANDARD DUTY PUSH BUTTONS
Bulletin 800. Up to three units, also pilot lights and switches.



FOOT SWITCH
Bulletin 805. In rugged die cast housing for toughest service.

8-59-RM

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

Manufacturers Literature

SILICONE RUBBER . . . for lead wire insulation. Comparisons between silicone rubber, polyvinyl chloride, neoprene and natural rubber as insulating materials furnished in text, in charts and tables of relative maximum operating temperatures, physical and electrical properties, and degrees of chemical resistance. Bulletin CDS-179, 4 pages. General Electric Co, Silicone Products Dept, Waterford, N. Y. **(H1)**

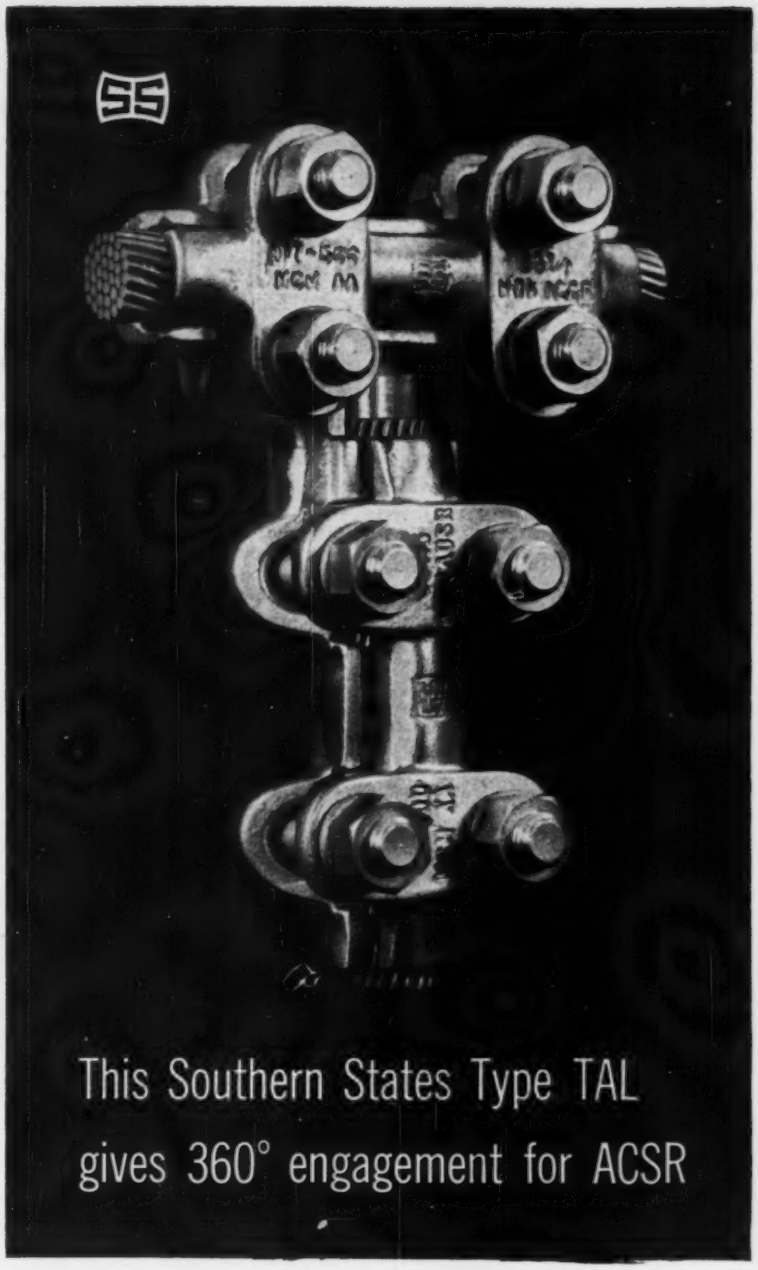
PHOSNIC BRONZE . . . Various forms, tempers, and properties of high copper alloy. Details of strength, creep and relaxation ressitance, and stress-strian, electrical and thermal characteristics. Tabular data covers various properties, plus comparisons with other alloys. Booklet, 8 pages. Chase Brass & Copper Co, Waterbury 20, Conn. **(H2)**

DC CIRCUIT BREAKERS . . . general purpose, Type FB, current-limiting, 1200 through 12,000 amp continuous-current, at 1000 dc. Available in one or two-pole models, with drawout or stationary construction, for either manual stored-energy or electrical closing. Can be applied to 1000-v dc circuits with current rise up to 15 million amp per sec. Bulletin S-4601-1A, 4 pages. I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia 30, Pa. **(H3)**

FLEXIBLE COUPLINGS . . . Dodge Para-flex, ranging from fractional to 190 hp per 100 rpm. New PX24, largest in line of 12 sizes, is capable of delivering up to 2,000 hp at 1080 rpm. No lubrication required; flexible element may be changed without removing flanges from shafts. Bulletin A669C, 12 pages. Dodge Mfg Corp, Mishawaka, Ind. **(H4)**

HEAT EXCHANGERS . . . mechanical and thermal design data for selection of standard sizes available in six types. Sizes run to about 1200 sq ft of surface. Exchangers are offered in carbon steel, also with non-ferrous tubes, and in stainless Types 304 and 316. Bulletin B-20, 20 pages. Struthers Wells Corp, Warren, Pa. **(H5)**

(*More Procurement & Products, p* 92)



The unique design features of this connector reflect the engineering behind the entire Southern States line of fittings. For instance, to assure good electrical and mechanical characteristics, it provides independent clamping on run and tap conductors; its maximum contact engagement minimizes conductor clamping stresses; and conductor-fitting grooves limit cable distortion.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA Dominion Cutout Co., Ltd., Toronto

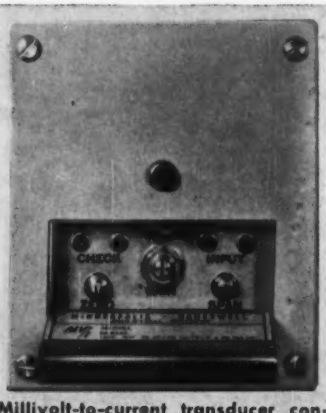
Telemeter and record

...with Honeywell Instruments

Combine the reliability and accuracy of the new Honeywell telemetering system with the traditional excellence of *ElectroniK* recorders . . . and you have an unbeatable combination for handling central station data.

Use the fully-transistorized telemetering system for load, control intelligence, or any variable that can be transduced into an electrical signal. It's designed to meet all central station requirements, and is suitable for carrier, microwave or direct-wire line channels.

Use *ElectroniK* instruments to record and indicate all telemetered variables with speed, precision and sensitivity . . . to give a clear, continuous,

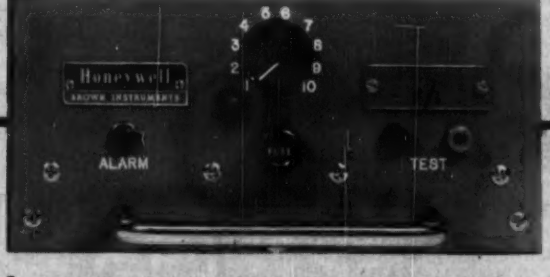


Millivolt-to-current transducer converts the mv signal of the sensing element to current.

Current-to-frequency transmitter converts current to a transmittable frequency that is a measure of the original variable.

HONEYWELL TELEMETERING SYSTEM . . . FULLY TRANSISTORIZED FOR GREATEST LONG-TERM RELIABILITY

Modular construction makes possible the unusual flexibility of this advanced telemetering system. The three basic units—transducer, transmitter, receiver—can be used in various combinations to provide the exact type of telemetering you need. The basic units mount two-abreast in standard relay racks. This fast-responding, frequency-type system gains stability and compactness through all-transistor design.



Frequency-to-current receiver converts the transmitted signal for recording and/or control purposes.

all variables...

permanent record of system operation.

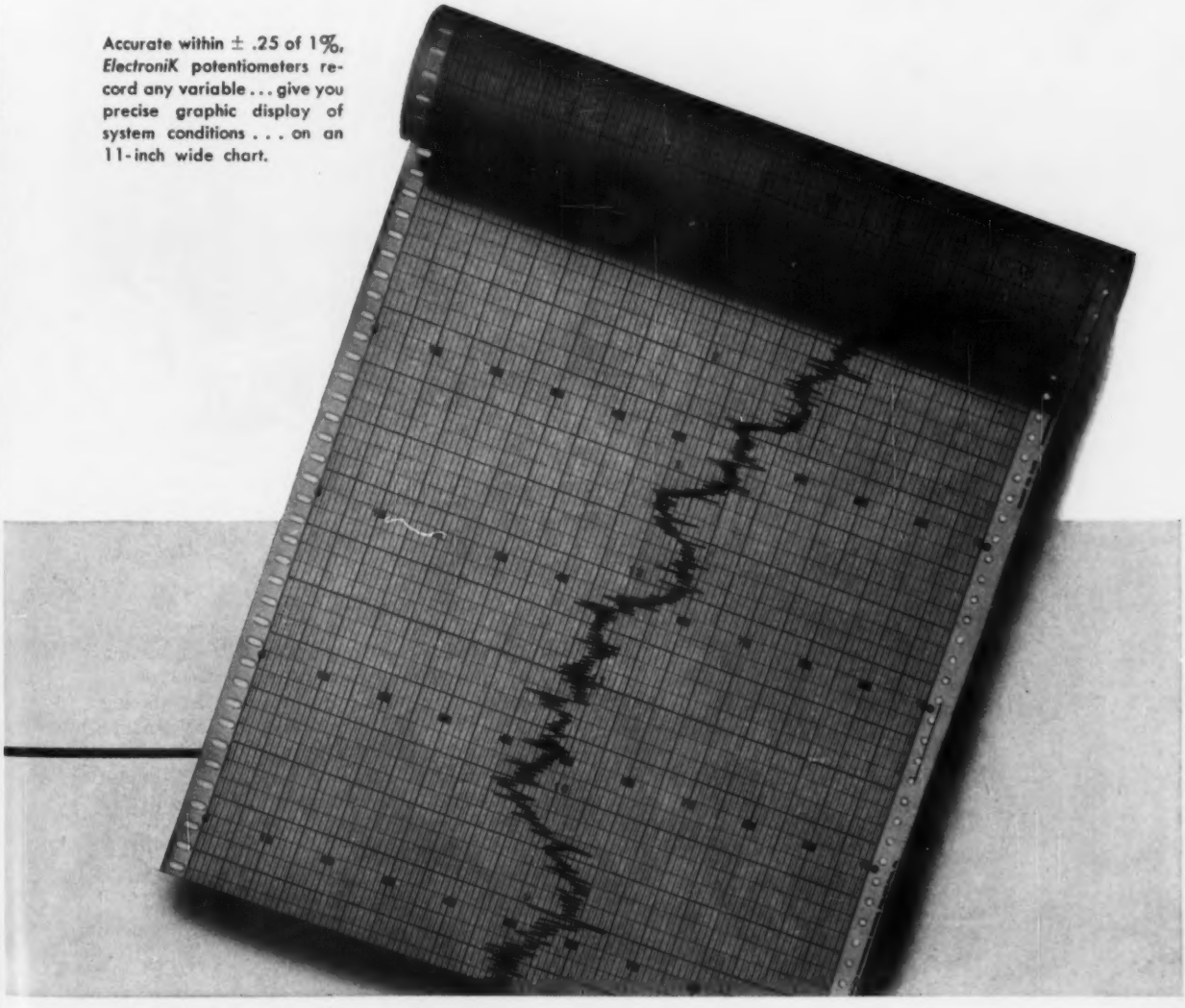
Your nearby Honeywell field engineer can help you match the telemetering system and *ElectroniK* recorders to your requirements. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

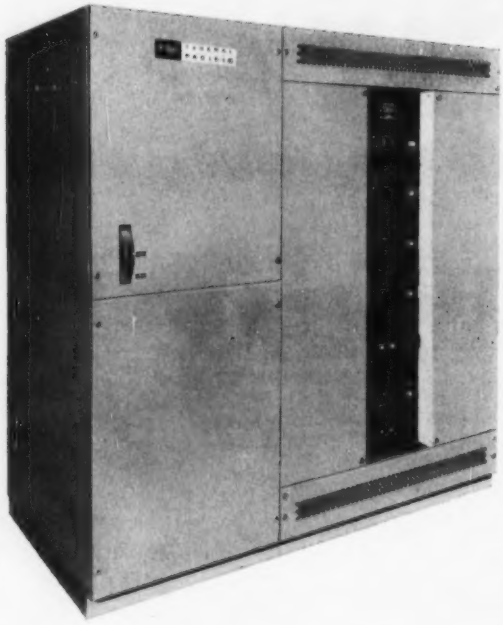
Honeywell

First in Control

Accurate within ± .25 of 1%, *ElectroniK* potentiometers record any variable . . . give you precise graphic display of system conditions . . . on an 11-inch wide chart.



(For further information refer to Readers Service on page 98)



Unit Substations . . .

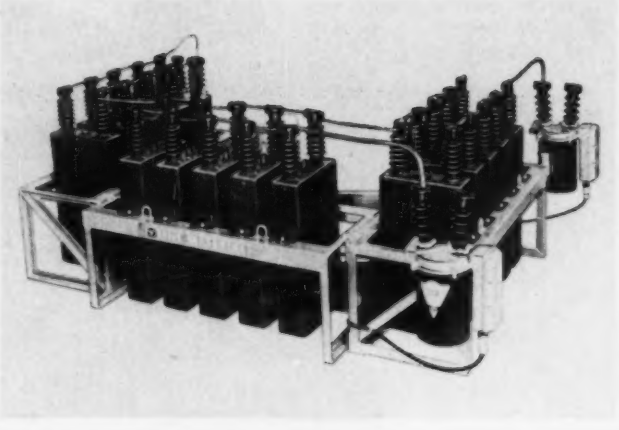
. . . rated up to 500 kva transform and control power at primary voltages of 5 to 15 kv to secondary distribution voltages at the point of use. Each Package Power Center consists of a unit enclosure incorporating primary switch, transformer, and secondary distribution sections. Primary sections are available with 5 and 15-kv fused and non-fused load break switches, or with 5 and 7.2-kv fused and non-fused oil cutouts. Transformer sections feature a 3-phase, 60-cycle, Class B dry-type transformer with four 2½% full capacity taps.

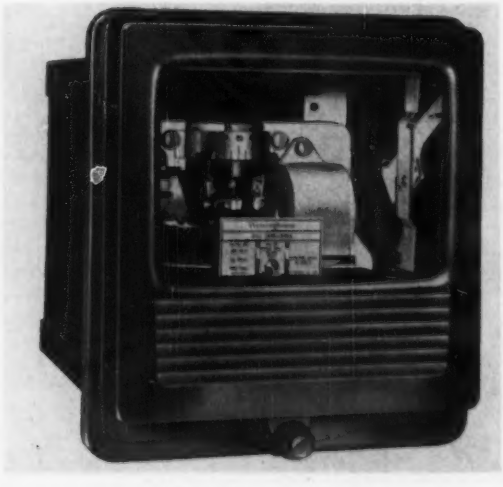
Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J.

Capacitor Racks . . .

. . . for 50-kvar capacitor units are available in both single-row and cluster-type racks. Single-row racks can accommodate 300, 450 or 600 kvar, while cluster-type racks can accommodate 450, 600 or 750 kvar. Racks may be mounted directly on the pole or may be pole-band mounted with an optional accessory. Both racks are fabricated of aluminum.

Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.





Relay . . .

. . . detects reverse phase connections of transmission lines, transformers, motors, generators or synchronous condensers. The CP relay is a 3-phase, contact-making voltmeter. One set of relay contacts closes on 3-phase overvoltage conditions, and the other set closes on 3-phase undervoltage, loss of voltage, reverse phase connection or serious phase unbalance. The main contacts of the relay close 30 amp at 250 v dc and carry this current for sufficient time to trip a circuit breaker.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

(*More New Equipment on page* 94)

fast-easy-sure!

FARGO DEAD ENDS

Automatic dead ends that are automatic. Fargo dead ends work right every time, and are designed for fast, easy and sure installations . . . a wide choice of flexible or solid coils and strap types to fit every job, all with Fargo's gripping units, are available.

new types...

There are Fargo Dead Ends for copper or aluminum.

NO SNAGGING WITH FARGO

Just push the conductor through . . . it goes without a hitch everytime. The secret is the one-piece jaw, and smooth internal sleeve . . . the one piece jaw assures alignment of each jaw segment while the internal sleeve safely guides the conductor through the spring zone eliminating the danger of a strand becoming snagged.

All Fargo dead ends are packed with a high temperature corrosion inhibitor and individually packaged.

Ask your Line Material Field Engineer for complete details.

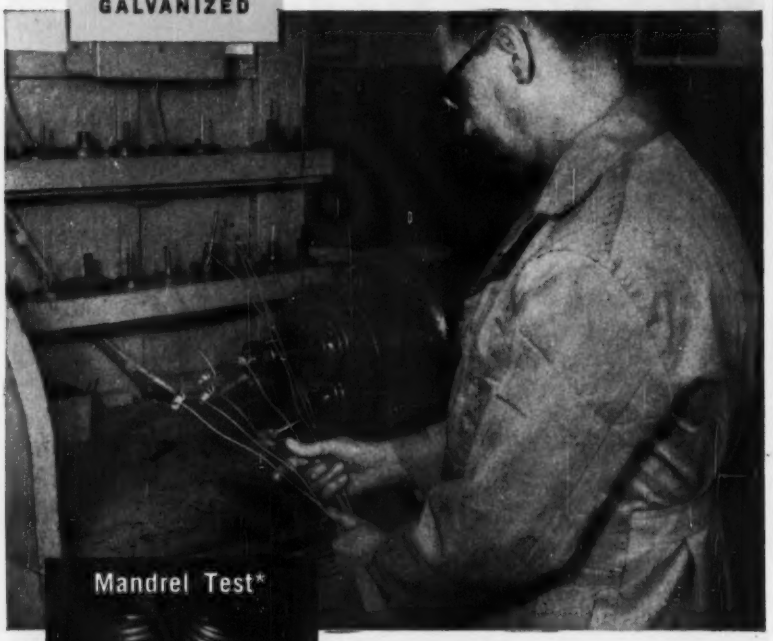
Distributed by
LINE MATERIAL INDUSTRIES
McGraw-Edison Company
Milwaukee, Wisconsin

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, New York

FARGO

Crapo GALVANIZED

STEEL STRAND



Mandrel Test*

Checked and Double-Checked by Laboratory Technicians

Every coil of wire used in the manufacture of *Crapo* Galvanized Steel Strand is tested and approved by trained laboratory technicians. Samples from both ends of each individual coil are subjected to a series of prescribed tests before stranding. Then, the finished strand is re-checked to make certain that it conforms in every respect to established specifications and our own high quality standards.

Thus you know when you specify *Crapo* Galvanized Strand that every precaution has been taken to assure maximum performance in the finished product.

Write for Free Booklet

"The Story Behind **Crapo** Galvanized Wire and Strand" illustrating and describing manufacturing techniques and testing procedures. Ask for Booklet B-59!

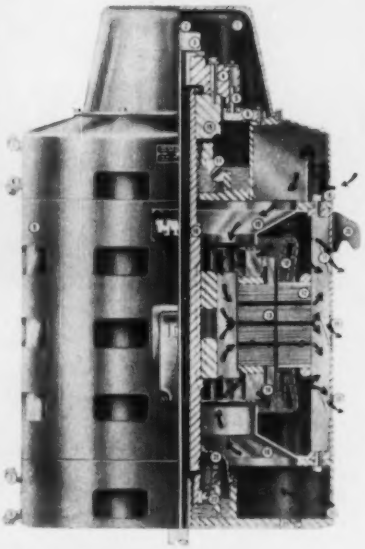
AVAILABLE IN 3 COATING WEIGHTS

FOR GUYS, MESSENGER AND OVERHEAD-GROUND WIRE

Crapo Steel Strand is available in all standard sizes and grades and in Class A, B and C galvanized coatings. Class B coating is twice as heavy as Class A coating; Class C coating is three times as heavy.

*Determines ductility of wire and adherent quality of galvanizing.

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana



Induction Motors . . .

. . . in high speed, squirrel cage, vertical models are available in all types of enclosures in sizes of 150 hp and up, frames 584 and larger. The motors have heavy duty, reinforced fabricated steel frames and are especially suited to unattended, intermittent - duty installations. Deep-bar copper rotors with extended ends for maximum heat dissipation are ventilated to permit air passage through cores and windings to attain lower, more uniform internal temperatures.

Ideal Electric and Mfg Co, Mansfield 48, Ohio.

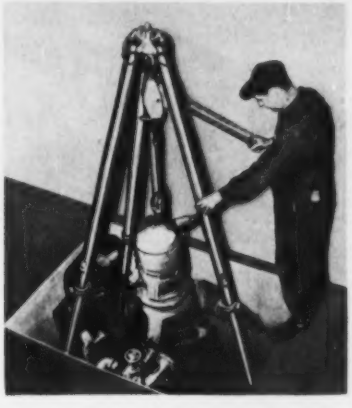
Safety Helmet . . .

. . . for use when throwing switches protects against flying sparks. The face shield is of clear acetate with a 4-in. wide green acetate strip at the top of the shield. A Reevecote neoprene-coated fiberglass fabric pro-

tects the chest and back of the neck. The helmet is known as Model 157. **Safety Products Div, American Optical Co, 14 Mechanic St, Southbridge, Mass.**

Tripod . . .

. . . for lifting loads in areas where no crane is available has adjustable legs. Eleven models of the Magic-Pole Tripod are offered. The ma-



chined alloy head has a free swivelling eyebolt which always hangs plumb, avoiding twist on the head. **B. E. Wallace Products Co, Exton DD, Pa.**

Stainless Steel Paint . . .

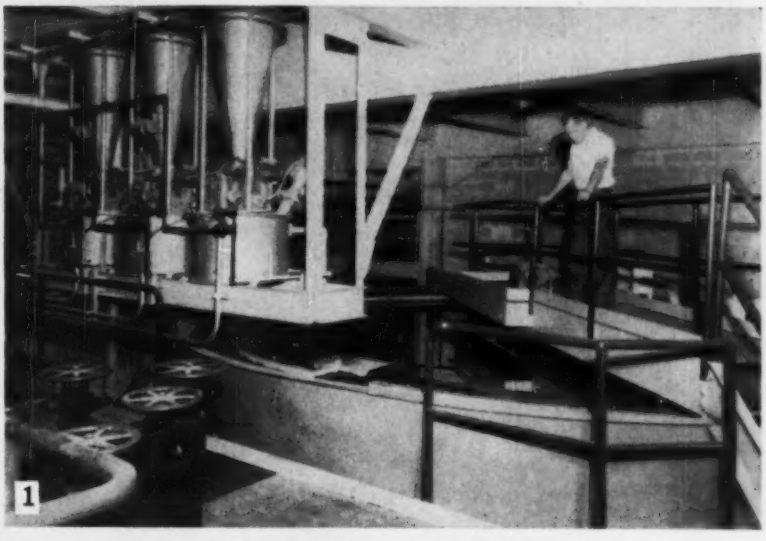
. . . protects exposed steel and aged galvanized iron. Life expectancy of the No. 13448 paint is at least 12 yr. The smooth surface readily sheds dirt. The paint contains mixtures of stainless steel flakes (18% Cr, 8% Ni) and non-metallic pigments in a long oil alkyd vehicle. It has successfully passed an 8-yr test on transmission towers in corrosive areas.
Vita-Var Corp, 10 Commerce Court, Newark 2, N. J.

Insulating Tape . . .

. . . for coil winding requires neither varnish nor bake treatment during application. "Dry" application is made possible by the tape's extreme flexibility and uniform thickness,

(*Continued on page* 98)

FLUIDICS* AT WORK



How new McMeekin Station treats its boiler water

Raw lake water from Lake Murray is the source for boiler feed at the new Silas C. McMeekin Station of South Carolina Electric and Gas Co.

Here's what the water analysis looks like:

Silica	9.0 ppm
Iron	0.8 ppm
Turbidity	15.0 ppm
Colorants	35.0 ppm
Electrolytes	50.0 ppm

Hardly the sort of water you put in a boiler operating at 2450 psig. So you'll find a complete Permutit water treatment system at McMeekin Station. Gilbert Associates, Inc., Reading, Pa., consultants on this job, report current results from the equipment as follows:

1. Precipitator and chemical feeders lower iron to 0.2 ppm, turbidity to less than 5 ppm, colorants to 2 ppm.

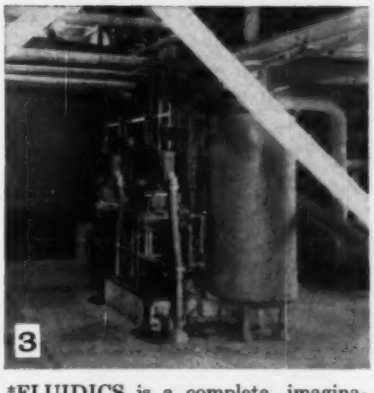
2. Three gravity filters further reduce turbidity to less than 1 ppm.

3. Complete demineralization plant, cation and anion exchangers lower the scale-forming silica to an inoffensive .02 ppm, electrolytes to .75 ppm.

4. Fully automatic Permutit control cubicle (not illustrated) remotely controls, monitors and records systems operation at all times.

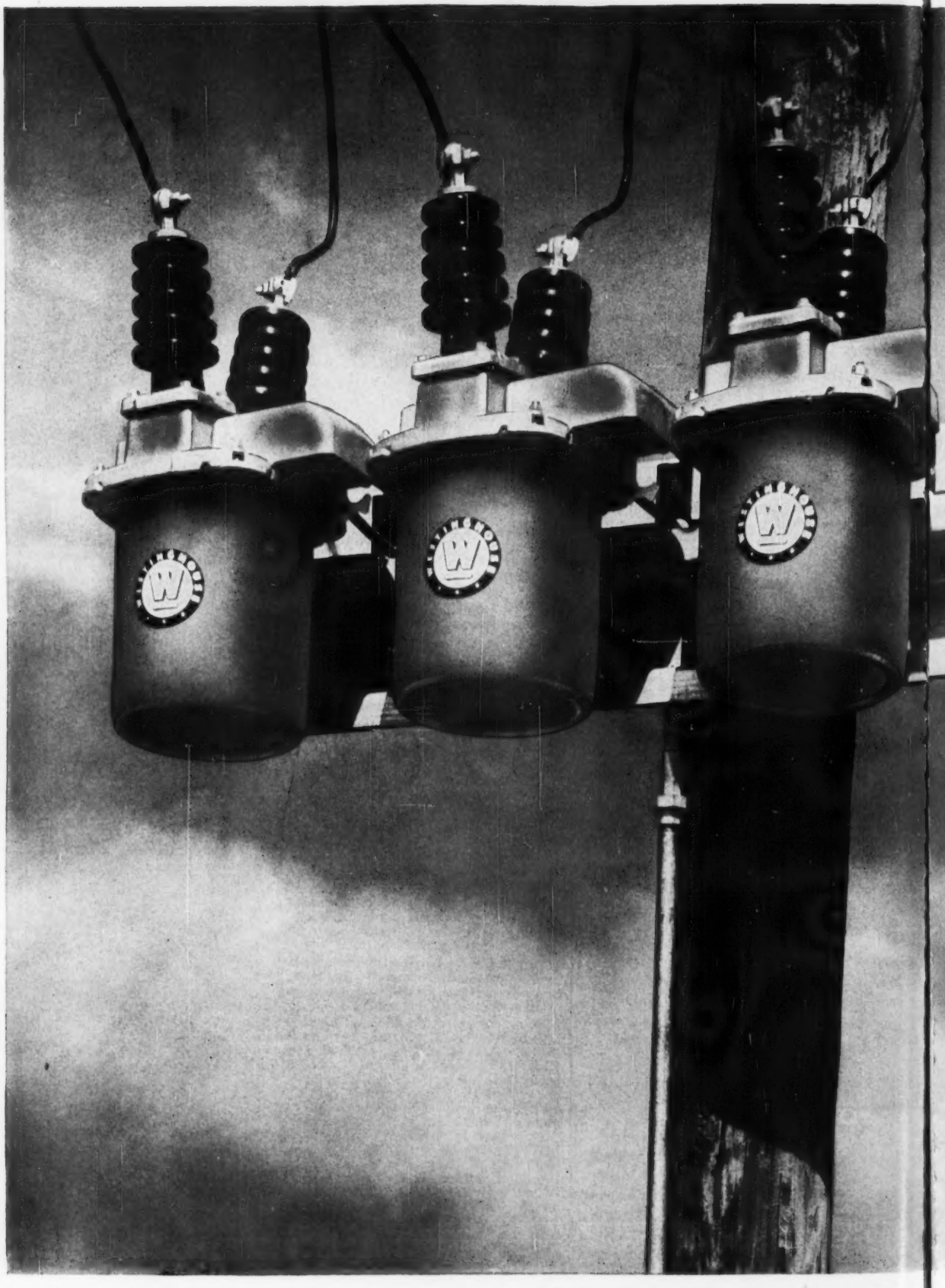
Such complete water treatment is typical of a Permutit installation and of the all-round service you get from our FLUIDICS program. If you have a boiler feed water problem, for example, our Permutit Division can provide everything you require from initial survey to final equipment system.

For more information, write PERMUTIT, 50 West 44th Street, New York 36, N. Y., or call your local Permutit representative.



*FLUIDICS is a complete, imaginative Pfaudler Permutit program which economically provides practical answers to problems involving liquids and gases.

PFAUDLER PERMUTIT INC.
Specialists in FLUIDICS...the science of fluid processes

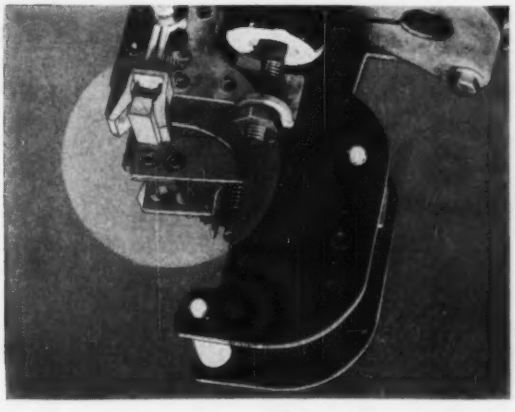


NEW WESTINGHOUSE CSL OIL SWITCH GIVES LONGER SERVICE LIFE, LOWER MAINTENANCE

The new 200-amp, 15-kv CSL embodies design advances which make it your best switching buy for pole-mounted capacitors, sports field lighting, street lighting, and sectionalizing applications. Improved thermal capacity, larger bushings with greater creep distances, increased dielectric strength of operating coils, finger-type contacts, and higher ratings are but a few of the CSL's outstanding features.

Faster closing contacts with positive wiping action

Initial contact is always made on the tips of the contacts, which are wiped clean as the closing cycle is completed, minimizing resistance even after repeated operations at maximum ratings. When the CSL is in the fully closed position, the current path is through surfaces of the contacts that are never subjected to strike. Contact speed has been increased to a minimum of 10 feet per second, helping to avoid reignitions and restrikes during capacitor switching. Moving and stationary control contacts are supported by a common member (see photo below), reducing alignment adjustments.



Solenoid-operated switching for fast contact opening

In addition to manual operation, the CSL switch offers the industry's only solenoid-operated switching for fast (2 cycle) contact opening. This quick response assures simultaneous operation of all three switches on a three-phase capacitor bank and prevents neutral shift and resulting high voltage to ground.

Longer life, lower maintenance

Control contacts are mounted above the oil, eliminating oil carbonization, reducing maintenance, and giving long, trouble-free service. Although the CSL switch has a guaranteed life of 10,000 operations, units have operated in excess of 30,000 times.

Let us show you how these higher-efficiency Westinghouse CSL oil switches can mean real dollars saved in your system. Call your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60987

RATINGS

voltage:

Nominal system voltage: up to 14,400 volts
Maximum design voltage: 15,000 volts
Basic impulse insulation level: 95 kv BIL
Control voltage (electrically operated switches): 120 or 240 volts

current:

Thermal rating: 200 amperes continuous
Momentary rating: 9000 amperes rms asymmetrical
Short time rating (1 second): 6000 amperes rms symmetrical
Maximum inrush current rating: 12,000 amperes peak

YOU CAN BE SURE... IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

Readers Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

Federal Pacific .....Substations ☐
Line Material .....Racks ☐
Westinghouse .....Relay ☐
Ideal .....Motors ☐
American Optical .....Helmet ☐
Wallace .....Tripod ☐
Vita-Var .....Paint ☐
GE .....Tape ☐
Ripley .....Adapter ☐
Joslyn .....Bracket ☐
Line Material .....Interlock ☐

MANUFACTURERS LITERATURE

Code No. .....

(Requests are made from code numbers on page 89).

OTHER

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* **Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.**

NAME _____
TITLE _____
DEPT. _____
COMPANY _____
ADDRESS _____

FOR:
Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

OCTOBER 26, 1959

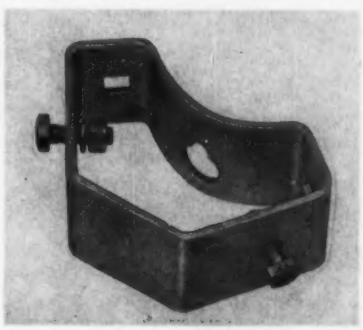
Insulating Tape . . .

(*Continued from page 95*)

which allows it to conform to surfaces in void-free layers. The tape uses four-layer construction that sandwiches ribbons of mica mat and glass cloth between two outside films of Mylar polyester insulation. **General Electric Co, Schenectady 5, N. Y.**

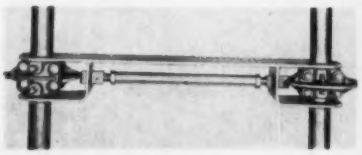
Unit Adapter . . .

. . . converts Form 110 luminaires from straight prong to twist lock receptacles. The Model 5980 Adapter is prewired, and both adapter plate and snap ring are of drawn aluminum, eliminating the need for a breakable glass cover. The external twist lock receptacle adapts to all types of controls regardless of diameter or height of equipment. **Ripley Co, Inc, Factory St, Middletown, Conn.**



Mounting Bracket . . .

. . . is used to mount small transformers together for paralleling. Two 1½, 3 or 5-kva units can be mounted with two J6752B brackets. Each bracket weighs less than 9 lb and is made of copper-bearing steel, hot dip galvanized. **Joslyn Mfg and Supply Co, 155 N Wacker Dr, Chicago 6, Ill.**



Mechanical Interlock . . .

. . . coordinates the operation of two or more groups of switches that operate through a range of 180 deg or less. It is applicable to all vertical-pipe, torsional-operating mechanisms. The mechanical interlock is a self-supporting apparatus. It can be installed between the operator and interphase linkage at any level on the operating mechanism. **Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.**

More New Products

Trouble-shooting lamp has 3/16-in. tempered plate glass shield to protect unit. The Jetlite provides relatively shadow-free spots of about 2,500 foot-candles at 3 ft and 1,500 foot-candles at 5 ft.—Burton Mfg Co, 2520 Colorado Ave, Santa Monica, Cal.

Totally enclosed fan duty **motor** is available in rerated NEMA frame sizes 182 through 326U (½ through 15 hp). The Type EFD motors are furnished in speeds of 1,800, 1,200 or 900 rpm.—Lima Electric Motor Co, Inc, Dept 75, Lima, Ohio.

Vise stand has folding tray of three-segment design hinge-bolted to stand legs. Yoke parts ⅛ to 2½ in. can be replaced by chain vise parts ½ to 4 in. on same base.—Nye Tool Co, Chicago, Ill.

Dust mask uses entire mask as filtering area. Called Resp-R-Aid, the mask is molded from one piece of urethane plastic.—Watchemoket Optical Co, 232 W Exchange St, Providence 3, R. I.

BARTLETT

More than 13 years ago Bartlett successfully pioneered the use of the helicopter for shade tree spraying—an operation that was to lead the way, a few years later, to a new efficient method of control of woody plants along utility rights-of-way.

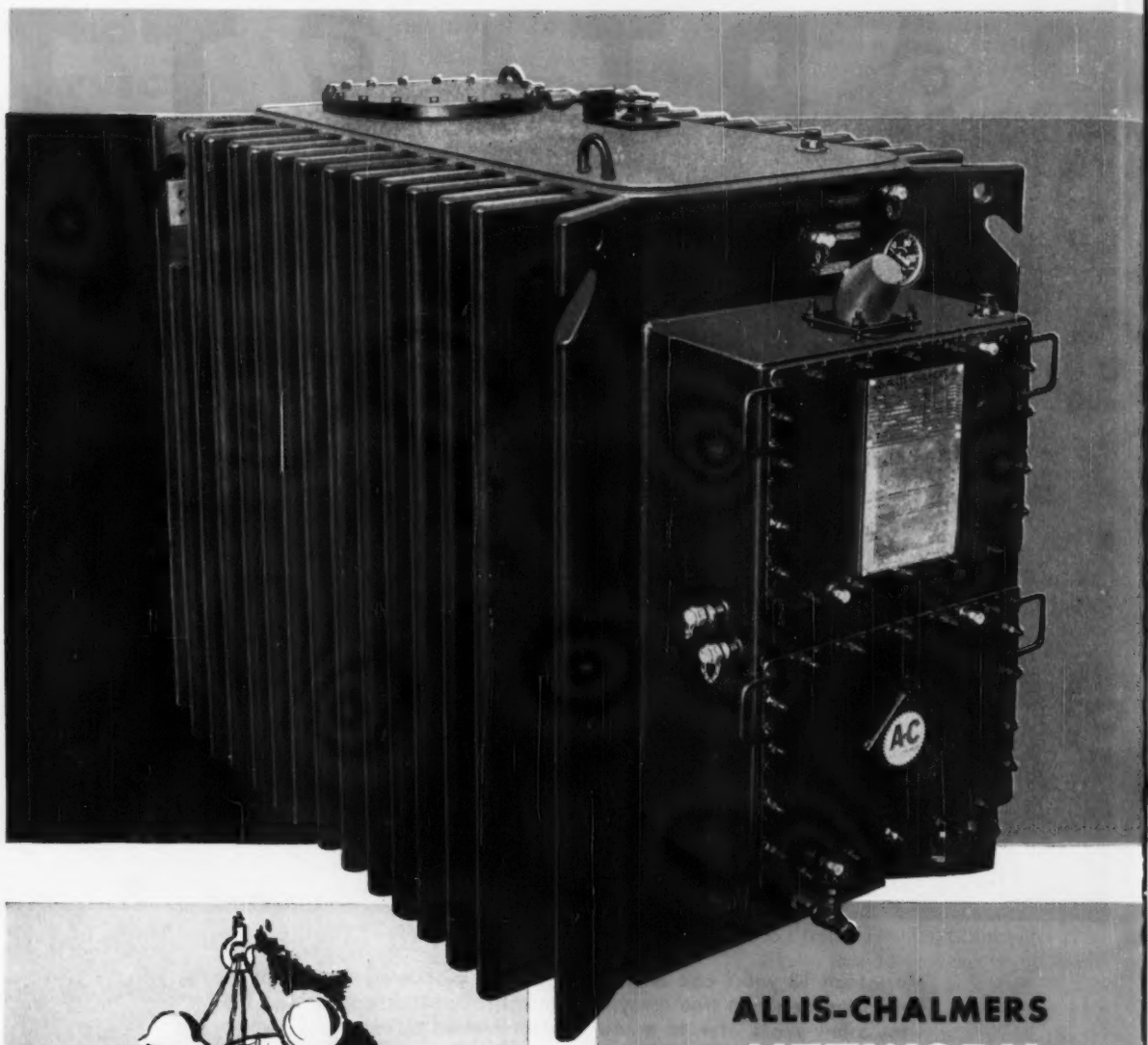
At first, difficult terrains presented unusual problems but gradually through research and experience, new equipment was developed and new herbicides and techniques perfected to overcome them. Today, Bartlett research in this important field is carried on continuously through college fellowships and at the Bartlett Research Laboratories.

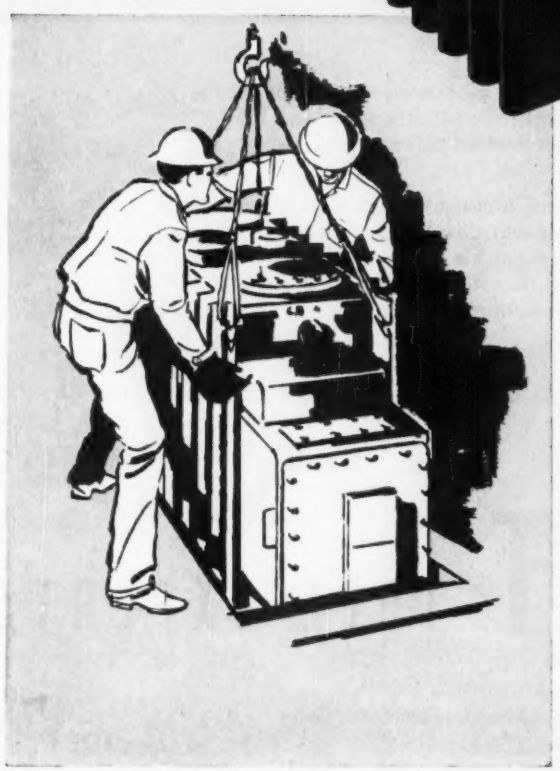
If your right-of-way clearance, line trimming, brush control or tree survey requirements present a problem, we invite you to share our years of experience. This service is now available from Maine to Florida, and west to Illinois and Alabama.

The Bartlett Way

BARTLETT TREE EXPERTS

Home Office, 2770 Summer Street, Stamford, Conn.
Research Laboratories and Experimental Grounds, Stamford, Conn.
Bartlett School of Tree Surgery, Stamford, Conn.





ALLIS-CHALMERS

NETWORK TRANSFORMERS

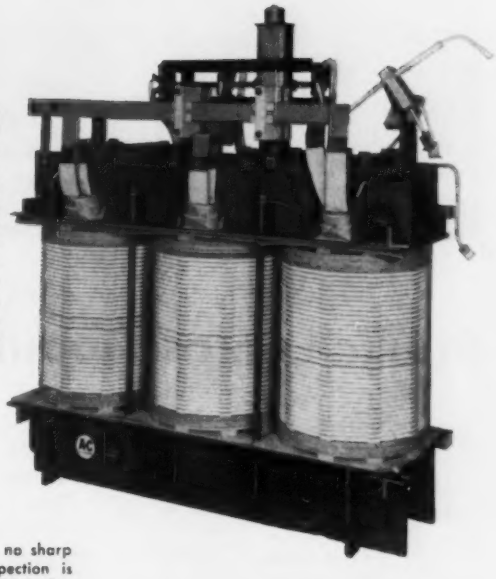
Truly New for True Economy

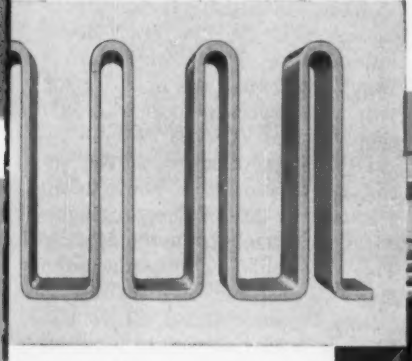
With equipment replacement costs increasing, it's more important than ever to demand maximum transformer value. When you buy that new transformer, look beyond the price tag for the advanced engineering that promises long-range economy. Insist on an assurance of bonus service years. Consider cost-cutting convenience in installation . . . in maintenance. In short, specify an Allis-Chalmers network transformer . . . the transformer that gives you everything that's new *now* . . . the transformer that will stay new for years to come.

ALLIS-CHALMERS modern line for '59

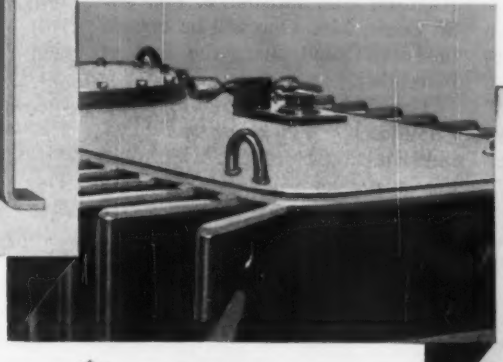
Smaller Vault Requirements per Kva

Compact core and coil assembly has reduced overall size and weight by an average of 15%. As a result, increased kva may be installed in existing vaults. Sizable savings are realized in excavation, construction and rental costs. With smaller, lighter transformers to handle, work crew efficiency is improved. From the performance stand-point, the compact core and coil assembly provides greater resistance to surge conditions and short-circuit stresses. Lower exciting current and lower losses afford additional system economies.



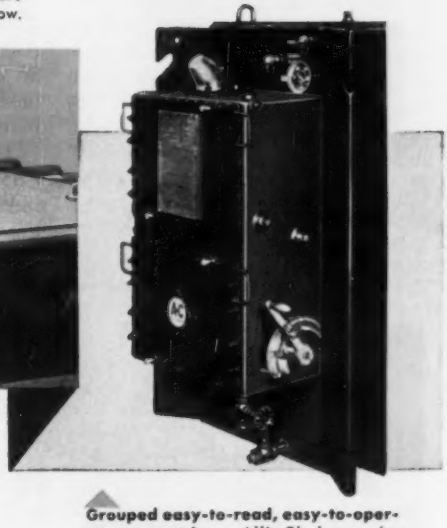


Corrugated tank design has no sharp corners or crevices. Visual inspection is quick and thorough. When repainting becomes necessary, all cooling surfaces are readily accessible with brush, spray or flow.



and Simplified Maintenance

Welding does away with most bolted connections. This results in a surface that stays cleaner longer. Welded-on covers cut maintenance costs considerably by eliminating gaskets.



Grouped easy-to-read, easy-to-operate accessories — Allis-Chalmers pioneered the time-saving convenience of grouped accessories. The importance of this development is reflected in today's industry standards.

Plan to stay ahead... MODERNIZE!

For detailed information, call your local Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-1027-E

Public Learns About Total Electric Home

Total Electric Homes, Westinghouse Electric Corp's answer to the gas industry's dominance in the new home market, are springing up all over the country.

Eight model homes, situated in such diverse points as Cheshire, Conn., and Santa Maria, Calif., and points in between, are being built to introduce the concept of total electric living to the American home buying public. Total electric living, according to Westinghouse, differs from the "all-electric home" in that it involves not only appliances but heating and cooling electrically, i. e. everything in the house is electric, there is no other source of energy of fuel.

The first was opened Sept. 12 in Connecticut, closely followed the next day by that in California. Homes have now also been opened in Turnersville, N. J. and Mentor Township, Ohio, near Cleveland, Augusta, Ga., Pittsburgh, Pa., and St. Louis, Mo. One will be opened in South Bend, Ind., the first of November.

The Total Electric Home in Cheshire is a 7½-room, split-level, redwood and limestone house built in cooperation with Westinghouse and The Connecticut Light & Power Co.

Newspaper ads, bill inserts, radio-TV, and "site folders" were used to notify the public of the approaching opening. Seventy-five hundred people attended the first open house and another 7,500 were turned away. The house was open for the next three weekends and 25,000 people visited.

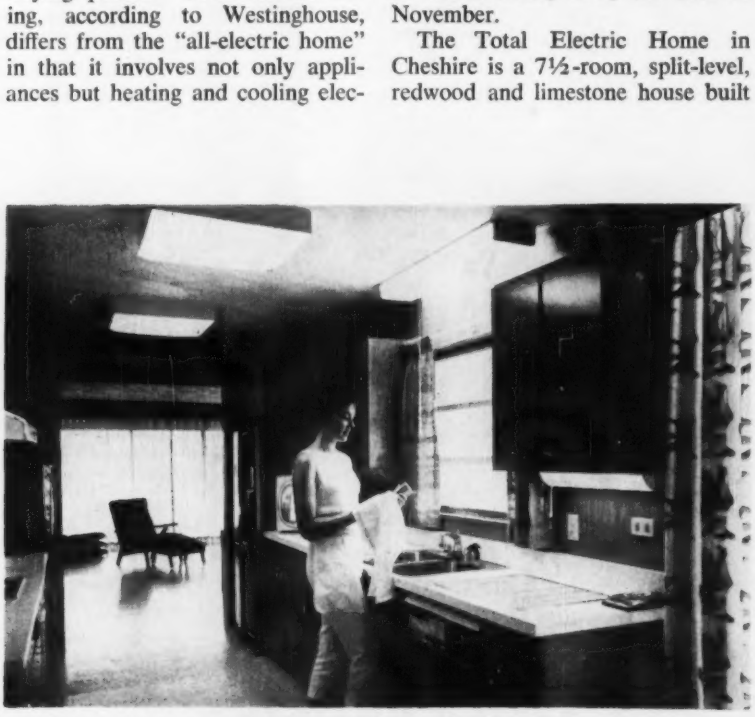
Other promotion by CL&P included a meeting at the house for all graduates of the Academy of Lighting Arts to demonstrate the lighting. This was held in cooperation with Hartford Electric Light Co and United Illuminating Co. CL&P also plans to hold open houses for prospective buyers.

In Santa Maria, two model homes, both Total Electric, were opened Sept. 13. The homes have been open daily from 10 am to 9 pm with Mrs. Thelma Fahrenkrog, Pacific Gas & Electric Co home economist, on hand to demonstrate the all-electric features of the model kitchens.

Plans call for construction of at least 90 Total Electric Homes in the California development.

Atlantic City Electric Co is getting into the promotion with a home in Turnersville, N. J. that was built under joint sponsorship with Westinghouse. In this case, the utility also joined forces with the builders; developers of the housing project; Lit Brothers, a Philadelphia depart-

(*Continued on page* 104)



BALANCED SHADOW-FREE lighting in the kitchen of Cleveland's Total Electric Home is supplied by two 2-ft fluorescent fixtures

For all conductor types—*Use*

KEARNEY Compression SPLICING SLEEVES

properly designed, fully tested, service proven—fully dependable

Versatile "O" Tool with interchangeable dies is the only one needed on many systems. Hydraulic tools and roll machines available for larger sleeves. KEARNEY provides COMPLETE tooling.

ACSR—Tension Sleeves. Coordinated short steel sleeve for splicing the core and long aluminum outer sleeve develop highest conductivity and holding power. Easily installed on live lines with Kearney Hi-Line Tools.

ACSR—Jumper Sleeves. Ample holding power for non-tension service, and full conductivity of the conductor developed by the single aluminum sleeve.

ALL-ALUMINUM—Tension Sleeves. Dependable splices under all conditions of physical and electrical loading.

ALL-ALUMINUM—Jumper Sleeves. Duplicates of tension sleeves in all details except length.

AAAC—Tension Sleeves. Full conductivity and adequate holding power for this new, hard alloy developed by a single aluminum sleeve . . . no special splicing procedure necessary.

COMPRESTO—Tension Sleeves. Spliced with Kearney sleeves designed for the equivalent sizes of conventional ACSR and aluminum . . . and with the same tools.

ACSR BOLTED JUMPER SLEEVES. Combine compression connection advantages with convenience of separability when necessary.

COPPER—Tension Sleeves. Made from pure copper seamless tubing . . . soft for easy compression and perfect bonding with conductor.

COPPER—Jumper Sleeves. Same characteristics and dimensions as tension sleeves, except shorter for non-tension service.

COPPER—HOT LINE Splicing Sleeves. Long taper at each bore end for easy insertion of conductor. Increased sleeve length compensates for taper to develop rated conductor breaking strength.

COPPERWELD—Tension Sleeves. Same high quality tubing as for copper conductor sleeves. Squeeze-down and length carefully coordinated to develop full strength and conductivity.

STEEL—Tension Sleeves. Widely used for full strength splicing of steel overhead ground wires and messengers. Hot dip tin plated.

TRIPLEX NEUTRAL—Splicing Sleeves. For splicing ACSR or all-aluminum messenger-neutrals of Triplex drop service cables.

INSULATED SPLICE FOR SPLITTING SECONDARIES. Quickest, low-cost way to do it! Need no changes in existing construction, no double dead-ends on crossarm, no additional materials. Standard tension type line splicing sleeves used . . . for aluminum and copper conductors.

For every conductor, there's a KEARNEY SLEEVE! In addition to the sleeves for all types of conductors—including the newest types—sleeves are developed on order for extending existing copper wire systems with aluminum. Every sleeve design rigorously tested . . . you can depend on KEARNEY performance.

JAMES R. KEARNEY CORPORATION *General Offices:* **4224-42 Clayton Ave., St. Louis 10, Mo.**

-375

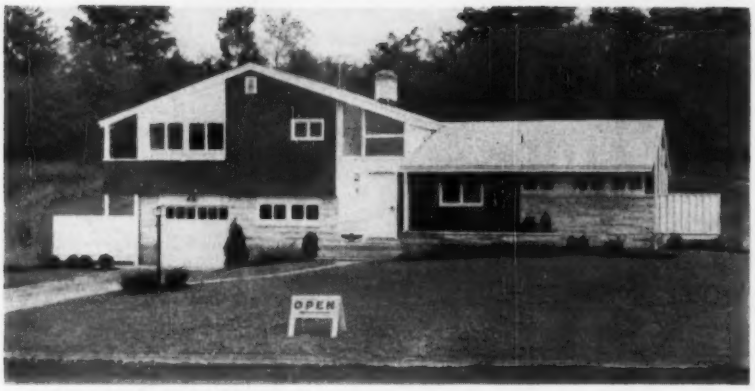
for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

The Mark of Quality

KEARNEY PRODUCTS

Plants at: ST. LOUIS • FAYETTEVILLE, ARKANSAS • [illegible]



CONNECTICUT'S TOTAL ELECTRIC home is a 7½-room, split-level, redwood and limestone house. Opening day 7,500 people viewed its electrical features

ment store; Owens Corning Fiberglas; and F. C. Russell Co.

The home's site was selected because of its proximity to a new Delaware River bridge, and the city of Philadelphia.

Approximately 200 persons attended a press preview opening on Sept. 17. At the public opening three days later, 5,000 people showed up. Nine Gold Medallion Homes (all Total Electric Homes are Gold Medallion) were sold, including the model and all its appliances and furnishings. By Sept. 22, four more had been sold.

Charles M. Hagan, Atlantic City Electric president, presented a Gold Medallion to the home's builder, Bernard Peskin.

Cleveland's Total Electric Home was opened Oct. 11 in Mentor Township.

The house has a 400-amp service entrance, approximately 150 lighting fixtures, 80 outdoors, and more than 90 wall outlets. Kitchen appliances include an electronic oven in addition to an electric oven.

Seven thousand and sixteen viewers saw the home on opening day. The county sheriff's deputies said the crowd was the largest they have ever seen at a model home opening. Cleveland Electric Illuminating Co President Elmer L. Lindseth hailed the house as "the house of tomorrow here today." Betty Furness assisted in the ceremony.

The home will be open for public inspection well into 1960.

Promotion included spot announcements on a Cleveland radio station every 10 minutes urging people to come out and see the house. There was also a radio broadcast on location.

At Augusta, 5,000 people attended the opening and police reported an unprecedented traffic jam. Remote radio and TV crews broadcast from the house.

Westinghouse reports that in the first two weeks the houses were open, $1 million worth were sold. Price ranges of Total Electric Homes are from $15,200 to 42,000.

"We are proving to builders and the public that Total Electric Homes can be built in any style, size, or price range and that they will sell," a Westinghouse spokesman said.

Features of the Typical Total Electric Home

Lighting. Valance lighting in the living and family rooms. Fluorescent fixtures in the kitchen. Over-all, 143 fixtures, 67 outside, 76 inside. Automatically controlled electric post lantern.

Heating and air conditioning. Five-ton heat pump. Fan-driven electric wall heaters in bathrooms and garage. Baseboard electric heaters with individual temperature control in other areas. Completely air conditioned.

Wiring. Fifty circuits and 90 wall outlets. Distribution panels instead of a fuse box, and 400-amp service entrance.

Entertainment center. Stereophonic hi-fi, am-fm radio, electric organ, TV, tape recorder, master intercom, movie projector.

Laundry center. Automatic washer-dryer, quick-recovery water heater.

Weather control center. Barometer, thermostat, thermometer, hygrometer, and windscope.

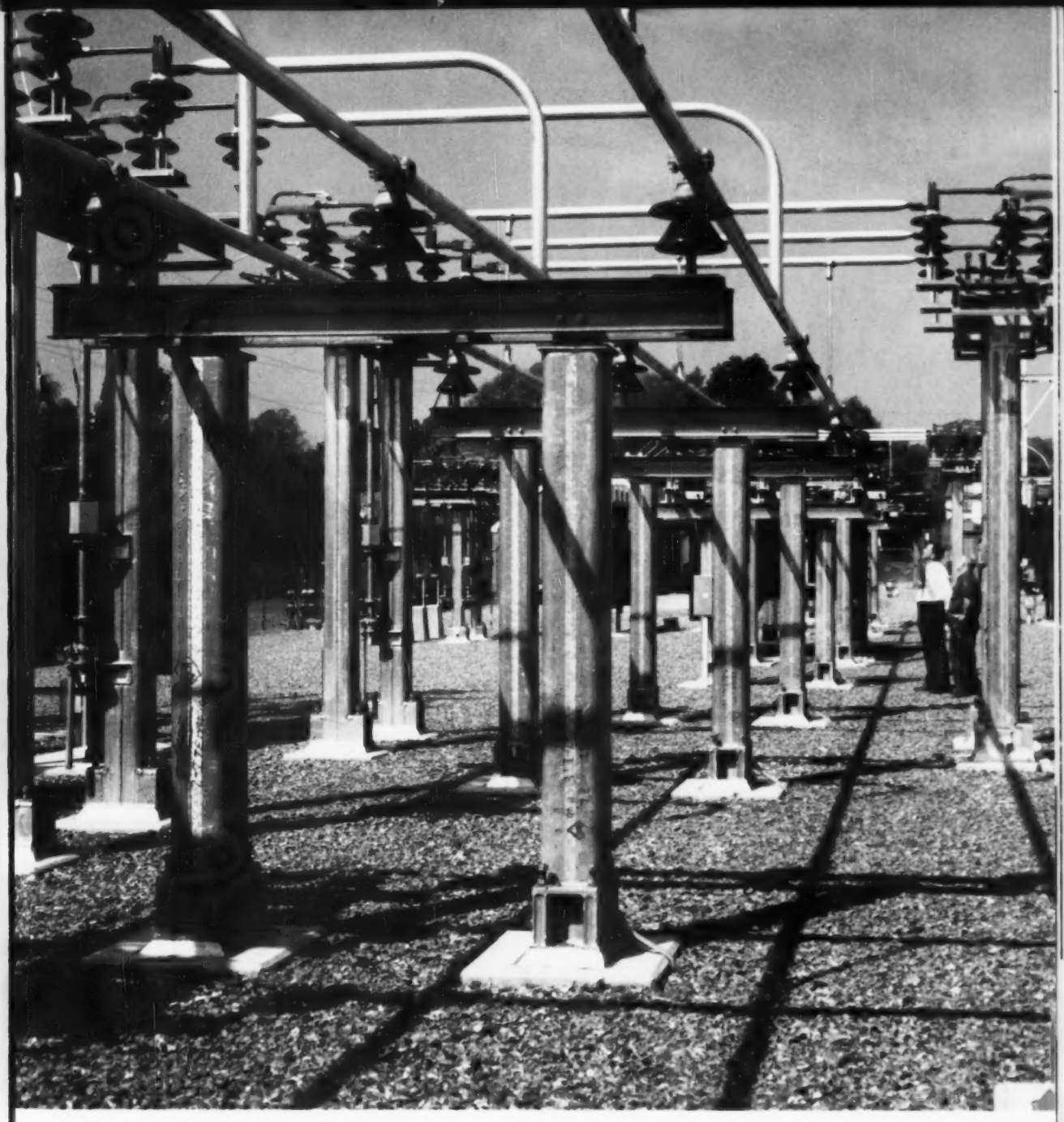
Food preparation center. Electronic range, roll-out dishwasher, food-waste disposer, exhaust and window fan.

SELLING BRIEFS

All-electric kitchen planning booklet has practical ideas for arranging equipment, planning a laundry area, increasing convenience, etc. Hints on proper wiring, lighting, decor, how to choose electric appliances, and remodeling are included. Write: Wisconsin Advertising Service, 2329 W. Wells St, Milwaukee 3, Wis.

General Electric Co has new ballast that delivers rated lamp current and provides maximum germicidal effectiveness for application in evaporative coolers and room air conditioners. Designated 6G3551, it is specifically for one G25T8 lamp to operate at 118 v, 60 cycles, at 600 milli-amps.

Electric heat installations in the Douglas County (Wash.) Public Utility District increased from 74 in 1958 to 104 in 1959. The District has also had application for 2,420 kw of electric heat since the first of the year. Thirty-three percent of the County's residents now use electric heat.



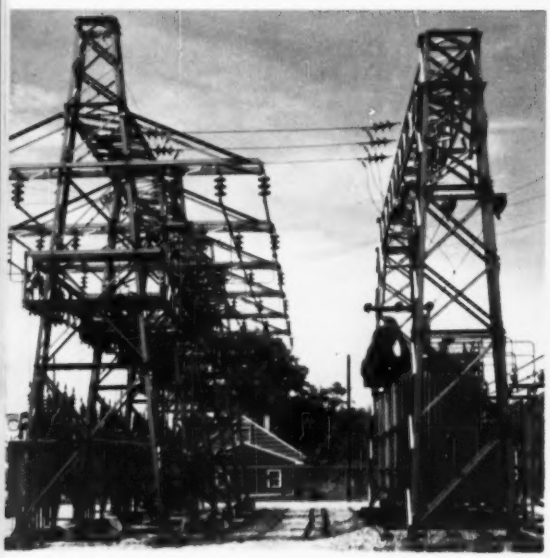
Philadelphia Electric's Bryn Mawr station utilizes a box column design in the structures. Columns were shop-fabricated by welding together two formed plate aluminum alloy channels. Use of aluminum bus also is another step toward an economical, maintenance-free station.

ALCOA RESEARCH

. . . development today for tomorrow's loads

HOW ALCOA ALUMINUM TRIMS COSTS IN SUBSTATION STRUCTURES

ALCOA STRUCTURAL ALUMINUM PROVIDES NEW ECONOMIES IN SUBSTATIONS



Pennsylvania Electric Company's switching yard at Erie is one of the earliest aluminum utility substation installations in the U.S. These aluminum structures are as sound and attractive today as when erected in 1946 . . . without a penny invested for maintenance or painting.

City of Seattle, Wash., Duwamish Substation.

Alcoa research for over 50 years has been devoted to a broad search for new and improved applications of aluminum within the electrical industry. The objective has been singular and unchanged: to reduce costs while advancing standards of performance.

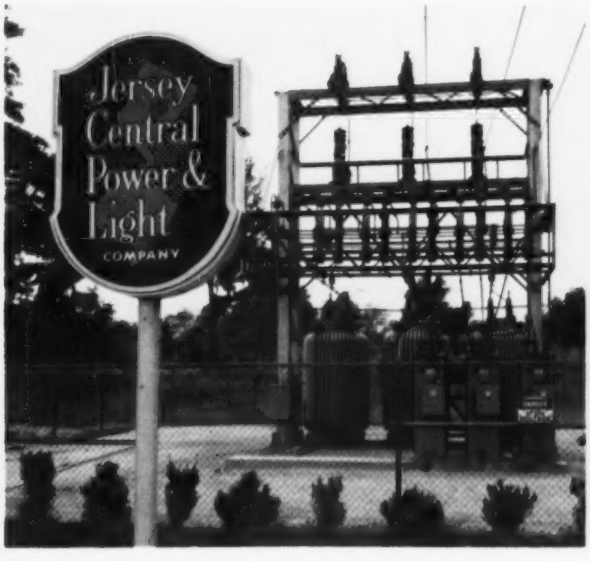
Over 10 years' experience with utility installations throughout the country has proven the many money-saving features of Alcoa® Aluminum for substation structures. Only a third the weight of steel, aluminum is much easier and cheaper to handle . . . often permits erection without any materials handling equipment at all! It can be fabricated with ordinary shop tools. But aluminum's real forte, of course, is its highly corrosion-resistant qualities. Aluminum structures, even where exposed to most corrosive industrial atmospheres, never need painting even after alteration in the field.

ALCOA ALUMINUM

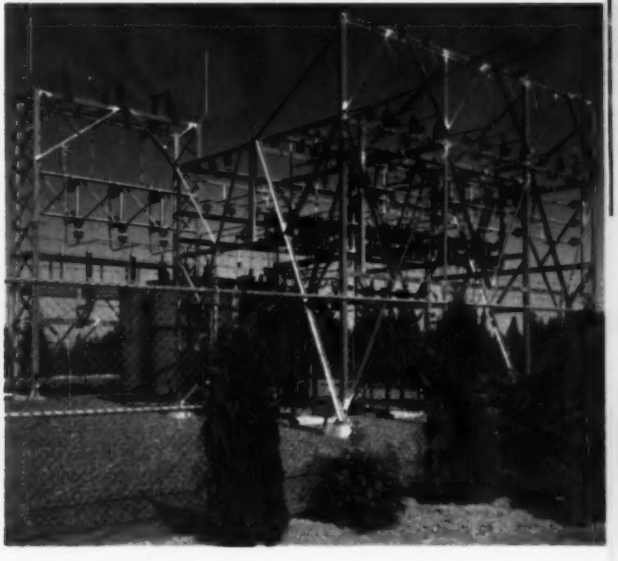
ALUMINUM COMPANY OF AMERICA

ALCOA RESEARCH

. . . development today
for tomorrow's loads



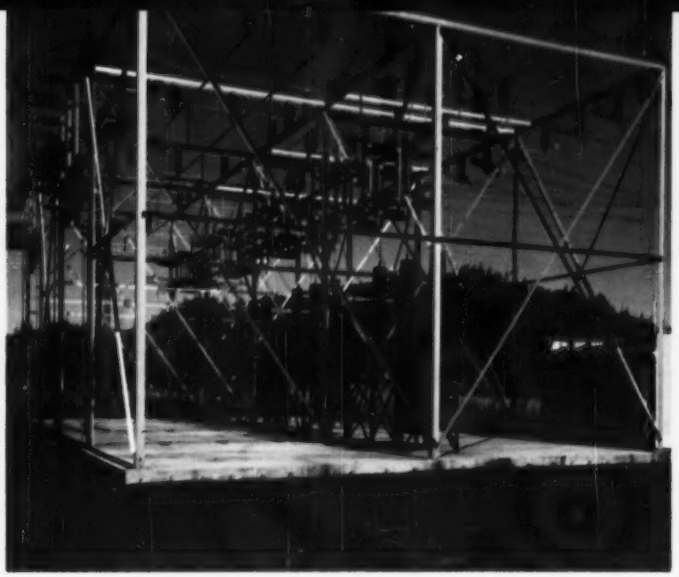
Alcoa Aluminum structures are ideal in coastal areas such as this Jersey Central Power & Light Company station near Lawrence Harbor, N. J. Aluminum is highly resistant to the corrosion that causes severe mortality in steel substation structures. Steel in this atmosphere usually requires two coats of paint every five years. Painting near energized circuits creates safety hazards . . . or requires outages for maintenance. Alcoa Aluminum never needs upkeep!



The bright, clean appearance of Alcoa Aluminum gives substations a good-neighbor atmosphere that is so important in suburban areas. Outdoor substations, like the L. M. Jones station of Clarke County Public Utility District, near Vancouver, Wash., present a consistent, like-new appearance over many years when made of lightweight, moneysaving aluminum.

ALCOA SUBSTATION STRUCTURES

. . . EASY TO INSTALL
. . . EASY TO HANDLE
. . . NO MAINTENANCE



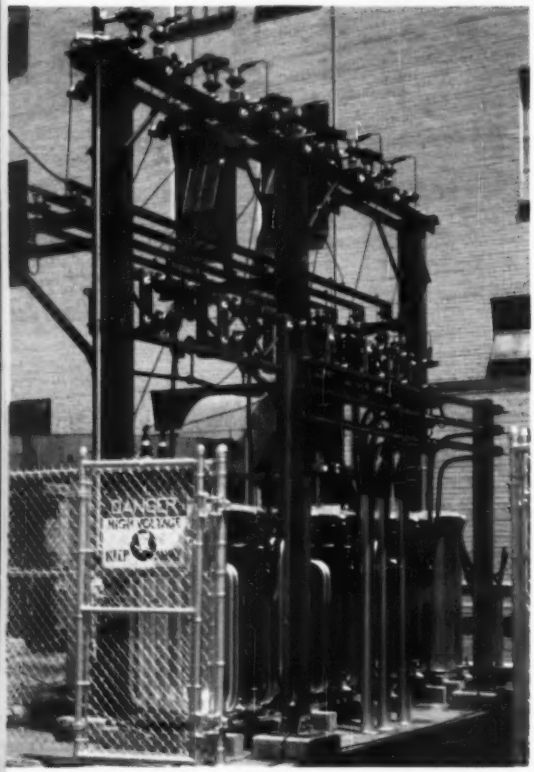
Cowlitz County P.U.D., Mount Solo switching station at Longview, Wash.

First installed experimentally for substations in the early 1940's, Alcoa Aluminum has rapidly gained wide acceptance as a structural material in large and small outdoor substation structures. Hundreds of thousands of tests have been conducted since those initial utility structures were designed to develop stronger, lighter and cheaper alloys that will give maximum corrosion resistance and still keep the bright, new appearance of aluminum.

Savings in handling and ease of erection help make Alcoa Aluminum more economical than any other structural material available. These features, combined with aluminum's maintenance-free characteristic, quickly offset any material price differential of the original structure compared to steel. Maintenance on steel structures in some corrosive atmospheres often equals the original cost during a 30-year span. Alcoa Aluminum requires no upkeep.

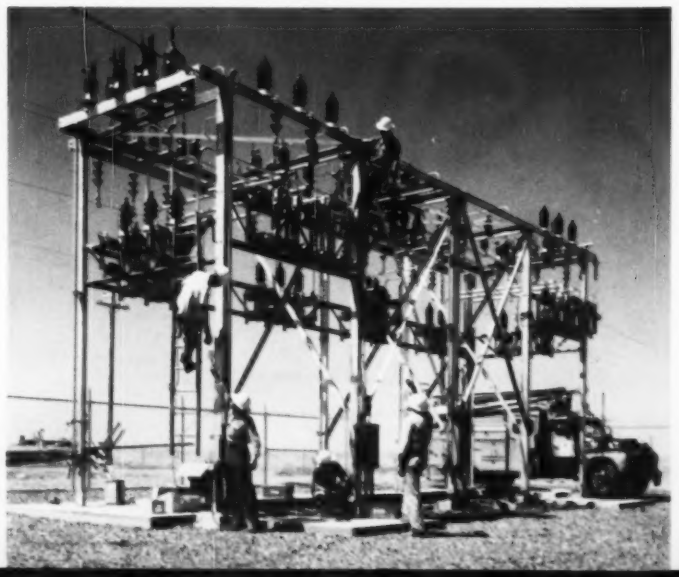
Light enough to be handled manually by the erection crew in most cases, aluminum structures can often be set up without cranes or derricks. Structures can be readily loaded on trucks and carried to the site by the crew.

The excellent electrical conductivity of aluminum is advantageous in facilitating grounding of electrical equipment . . . another saving with Alcoa Aluminum.



The aluminum substation constructed at Alcoa's Research Laboratory in New Kensington, Pa., in 1945 is believed to be the first. Fourteen years of continuous service by this Alcoa pioneer effort has confirmed the economies of aluminum as a structural material. The aluminum is as sound as the day it was erected . . . with no maintenance.

Larson switching station, Grant County P.U.D. near Moses Lake, Wash.



Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM

"... The pressures which have operated to devalue the dollar ... are not going to disappear overnight."

Nearly 900 N.A.R.U.C. members and guests hear . . .

Report on
Rates and Regulation

The Commissioners Talk Inflation

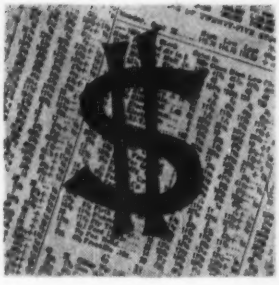
Inflation stayed close to the center of the stage throughout the 71st annual convention of the National Association of Railroad and Utilities Commissioners, which was held in Philadelphia Oct. 12-15. Two major speeches placed the effects of inflation on rates and on utility financing squarely in the spotlight. Many of the committee reports and some of the "workshop" discussion groups also dealt with inflation directly; and even when it was not specifically mentioned, it stood in the wings—casting its shadow over the convention and coloring the discussion of many apparently unrelated problems.

Retiring President Matt L. McWhorter in his opening address, expressed a conviction to his fellow commissioners that "we are all going to be faced with mounting pressure for recognition of the 'cost of money concept' in our rate making." And if any of the nearly 900 members and guests present at the convention had arrived without being aware that inflation was a pressing problem, they could not have gone home without having that misconception corrected.

Inflation does not affect all regulatory personnel in the same way. One effect, noticeable early in the meeting, is to cause the members of commission staffs to sharpen their pencils. During one hour on the first day of the convention, it was possible to hear: (1) A justification for reducing the interest-during-construction credit, (2) Advice on how a commission might trim working capital from the rate base, and (3) Possible ways to dock a utility's rate of return on the grounds that its service is poor. Comments in a number of the "workshop" sessions left the impression that some regulatory personnel are primarily concerned with rationalizing a palatable level of electric rates, regardless of their adequacy or inadequacy.

But many commissioners showed that they were aware of the problem of inflation from the standpoint of the utility company as well as the consumer. The N.A.R.U.C. Committee on Corporate Finance wrote in its report: "With the outlook for continued inflation . . . utilities will have to offer their investors opportunities commensurate with alternative investment in order to obtain the

necessary funds . . . This Committee suggests that Commissions, as well as utilities, take careful consideration of the economic climate in today's world in setting rates. The postwar period has been one of tremendous growth attendant with a rising price level as a result of the postwar inflation. The prospect for the future is for continuation of the past pattern of growth and inflation . . . As has been demonstrated by the earnings of unregulated business, during periods of growth earnings must necessarily be at high levels, otherwise new capital will not be injected into the economy."



A Financial 'Two-Way Squeeze'

The Chairman of the Securities & Exchange Commission struck the same note somewhat more forcefully. In a speech entitled "Inflation and Its Effect on Utility Financing," SEC Chief Edward N. Gadsby laid down a solid statistical base on which to build his conclusions. He pointed out that in 1958 more than half of the new securities offered came from regulated industry, although their capital represents only about 21.5% of the total capital of all American corporations. In the past ten years, Class A & B electric utilities increased their total installed capacity from about 45 million kw to 112.7 million kw—a growth of 150%—while general business activity increased by only about 50%. Meanwhile the utilities' construction costs rose 60%; the price of coal, 16%; and average hourly wages of employees increased by nearly 70%.

"Thus, the utility industry has been the victim of a two-way squeeze since the war," said Gadsby. "In one direction, it has been subjected to the pressure of mushrooming demands for additional service and, on the other hand, the plant which it has had to construct in order to provide such service has become more and more expensive. In the course of what has been, to all intents and purposes, a revamping of the utility plant structure, nation-wide, the industry has issued the rather awe-inspiring total of $48.8 billion in new securities . . ."

This squeeze has been bearable because the electric utilities have built larger and more efficient steam plants, effected economies in production and other operating expenses, built up the load and improved the load factor, Gadsby said. In fact, economic pressure has been instrumental in inspiring the "bold experimentation" which has been responsible for many of these advances. But it has also caused some changes in the position of utility securities.

In the first quarter of 1949, a dollar of earnings on utility common stock was selling for an average of $10.70, according to SEC figures. In the second quarter of 1959, a dollar of earnings sold for $17.56. Over the ten years, earnings per share went up 53%; dividends per share, 71%; and market price per share, 151%. Meanwhile, the composite rate of return of privately-owned Class A & B electric utilities has declined from 6.2% to 5.7%. Interest coverage has dropped from 4.2 times in 1948 to 3.4 times in 1958. Yet the utilities' rate of return on common stock equity has increased from 9.9% to 10.8% during the period.

Regulatory commissions must consider these trends in deciding rate cases, Gadsby said. "It is perfectly obvious that there is going to continue to be a continual flood of new utility security issues for as long in the future as we can see. In fact, I am not at all sure that the demand for new money is not going to overlap the heavy refunding requirements of some years hence. Some of the debt issues floated in the 1940's will, after all, come up for refunding in the not-too-distant future at a time when there may very possibly be a great demand for new money. All of [these] factors . . . , and doubtless many more, will continue to be important even if the inflationary trend is interrupted today.

"The farsighted management will stress the importance of these factors in the rate case record and will emphasize the importance of neutralizing the inflation-

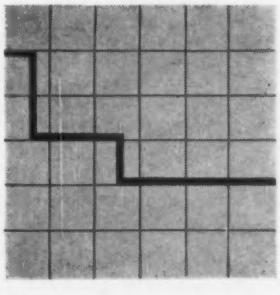
ary trend by proper rate treatment. The equally farsighted regulatory agency, on the other hand, will recognize these difficulties and make proper allowance for them in its deliberations. I submit that the trends I have noted call for the most statesmanlike action in order that the utilities may be able to go to the securities markets and raise the funds which they will require at a reasonable cost to them and to the consumer.

"There has been a race for the past few years between technological improvements in the utility industry on the one hand, and, on the other hand, increases in costs over which the utilities have no control. On balance and at least up until now, the electric utility companies seem to be ahead. Utility common stocks have gained a new stature among investors. Whereas they had for many years been regarded as a strictly defensive yield security, they have in recent years gained a new status—that of a limited growth security. I have pointed out the growth in per-share earnings and the increasing value which the market has placed on utility common equities beyond the normal increase to be expected as a consequence of increased earnings.

"Informed opinion . . . seems to be divided as to what must be done in the future to consolidate the gains heretofore made and to continue to progress. One group, perhaps rather pessimistically, believes that technological advances will not be adequate in the future to overcome mounting inflation, and that substantial rate increases must be granted by the state regulatory commissions; and they call for emphasis on reproduction values and allowances of so-called economic depreciation for rate-making purposes. The other group, perhaps rather optimistically, argues that the electric utilities do not need to rely primarily on rate increases but must and can meet inflation on two fronts, i.e., by technological advances and by load growth.

"I do not pretend to say which of these groups is right. Perhaps history will prove they both have some substance in their arguments. Neither am I prepared to forecast whether current events will result in a continued inflationary trend. However, I cannot believe that the existing price level is going to deteriorate radically in the near future. The recession of 1958, if it did nothing else, would seem to have proved that much.

"Personally, post-war history convinces me that the pressures which have operated to devalue the dollar for the past ten or fifteen years are not going to disappear overnight, and that the problems I have mentioned will remain for some time to come," Gadsby concluded. "Regardless of the extent of future inflation, however, I do feel that it is incumbent on us, as regulatory agencies acting within our respective jurisdictions, to be sufficiently elastic in our points of view so that the public utilities of the country can meet the financial problems raised by the inflationary cycle as they may become more pressing and, perhaps, before they become acute."



A Prescription for Realistic Rate Making

Just how to meet these problems in setting rates was the topic of Alan S. Boyd, of the Florida Railroad & Public Utilities Commission. He discussed the original cost, reproduction cost, and fair value theories, noting that "rate making is historically an art rather than a science" and that "no matter what method of rate making is involved, there comes a time when the regulatory agency must exercise its judgment in establishing a fair rate of return."

Assuming that the commission honestly desires to establish a fair rate of return, Boyd said that the original cost rate base was best because it is simplest. "Since it is possible to calculate precisely the rate base using the original cost method," he said, "the rate of return is the only area calling for informed judgment. In

both the fair value and reproduction cost theories, the regulatory agency may compound any error on rate of return through error in judgment in establishing the rate base."

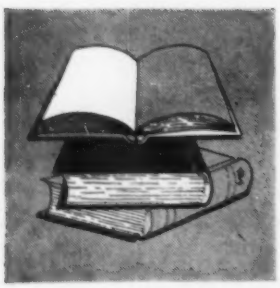
"Major criticisms of the original cost rate base," Boyd said, "seem to be (1) insufficient rate of return allowed, and (2) failure to comprehend adequate depreciation reserves in time of inflation. If my belief is correct, it strikes me that these are criticisms of procedure rather than of the rate base concept."

Boyd also had some candid advice for the utilities in their regulatory relations. "Regulatory agencies are to some extent like little boys," he said. "They are inclined to be afraid of the dark. New theories on how to cope with inflation should not be sprung in a rate case. Regulatory personnel should be afforded an opportunity to educate themselves at a time when not subject to the pressure of reaching an immediate decision . . . There is a lot of fuzzy thinking on the problem of inflation both within the industry and regulatory agencies. Industry is prone to cry 'Wolf' without particularly convincing arguments. Regulation has a tendency to ignore the problem of inflation on the theory that it may go away . . . Inflation as a specific problem in public utility rate making can only be dealt with adequately if its impact is so identified that regulation will know with what it is dealing.

"The regulation of public utilities does not operate in a vacuum. . . . The facts are that [it] is subject to many political currents both obvious and unseen. In states where regulatory personnel are elected, the office holders will ordinarily reach decisions which they feel coincide with the sense of the people. In other states where regulatory personnel are appointed, it is not unique for regulatory policy to become issues of gubernatorial campaigns. Appointees will normally attempt to apply the stated policy of the governor. . . . It is manifest that if regulated business is to obtain greater returns . . . during periods of inflation, there must be some educational process directed at the public. . . .

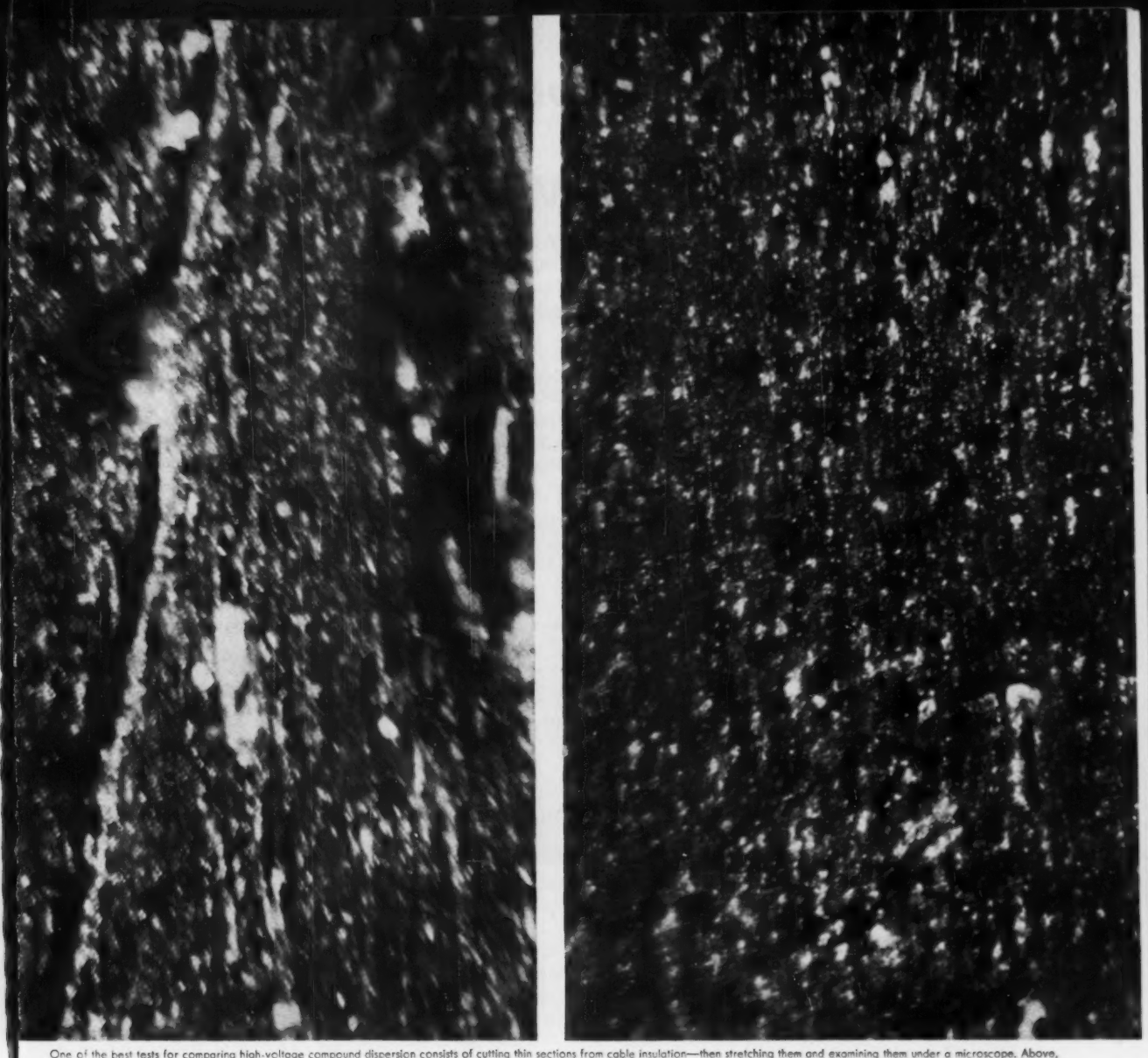
"Regulated industry has a great public relations message to sell. Indexes will show that costs have jumped and per-capita income has risen while utility charges to the public have increased only slightly on a comparative basis or have actually decreased. This is a wonderful public relations message, and each utility needs a town crier to spread the word. Information of this type will be most helpful in improving the stature of utilities in the public eye.

"Some day the utilities will become aware of two basic facts. The first is that it is in their interest to do whatever is necessary to provide regulation with the best possible personnel and resources. The second is that somebody will develop a means of presenting a rate case so that the general public will understand the facts and the issues. . . ."



A Lesson for Utilities?

The fact is that commissions are caught in an embarrassing squeeze themselves, as Boyd stated directly and many other speakers implied. They realize that the utilities have a problem requiring solution. At the same time, it is hard to convince consumers who have grown accustomed to stable or declining electric rates that the honeymoon is over and they will have to accept higher rates in the future. Perhaps the most important lesson to be gained from this year's N.A.R.U.C. meeting is simply that a utility that seeks a rate increase should do more preparing in advance. This includes not only the thorough and careful preparation of the rate case itself, but also a program of educating the public as to the need for it. Such a program would help relax the squeeze on the commission, and this, in turn, might well result in less pressure on the utility when it presents its case.



One of the best tests for comparing high-voltage compound dispersion consists of cutting thin sections from cable insulation—then stretching them and examining them under a microscope. Above, you see magnified sections of ordinary cable insulation (left) and Anaconda Butyl (AB) insulation (right). Note the even grain structure, the better dispersion of the Anaconda Butyl (AB) Cable.

IT TAKES A MICROSCOPE TO TELL THE DIFFERENCE BUT THE DIFFERENCE IS CRUCIAL

en butyl—the most effective rubber insulating material er developed for high-voltage cable—requires additives to ing out all its superb insulating properties. These additives e usually in the form of finely divided powders which are remely difficult to disperse uniformly in the raw butyl.

The microscope helps show you that conventional mixing pper left micrograph) produces poor uniformity, leaves ny additive particles undispersed. Actual service proves se flaws drastically shorten your high-voltage cable life.

That's why Anaconda developed an entirely new mixing ocess. In fact, built a new plant for just one product—aconda Butyl (AB) Cable. The micrograph on the right ps show you one result—uniform, better dispersed insulation. And actual service proves this means long trouble-free cable life.

For real long-range economy, specify Anaconda Butyl (AB) Cable when you buy high-voltage cable. Send for Publication DM 5903: High-Voltage Durasheath* Cable to Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. 5925

ASK THE MAN FROM

ANACONDA®

ABOUT BUTYL (AB) HIGH-VOLTAGE CABLE

Corby Made Purchasing Agent

Bruce S. Corby has been named purchasing agent at Central Hudson Gas & Electric Corp. Other appointments are: Ronald A. Dickson, general cashier, Raymond G. Erickson, manager of a newly created Public Relations and Information Division, and Anthony S. Megargee, advertising director.

The purchasing department under Corby will be consolidated with the operating department under the general direction of Vice President-Operations Ernest E. Althouse.

Corby joined Central Hudson in 1952 as assistant to the purchasing agent. He has been assistant purchasing agent since 1958.

He is a member of Edison Electric Institute's Purchasing and Stores Committee and the N. Y. chapter, National Assn of Purchasing Agents

General Motors' Electro-Motive Division Promotes Three

Three promotions have been made in the Electro-Motive Division of General Motors Corp.

C. R. Osborn has been elected executive vice president of the corporation and will have jurisdiction over the Engine Divisions; the Dayton, Household Appliance and Electro-Motive group, and the Overseas and Canadian group. Nelson C. Dezendorf will be vice president in charge of the Dayton, Household Appliance and Electro-Motive group, and Richard L. Terrell, has been elected a vice president of General Motors and will succeed Dezendorf as general manager of the Electro-Motive Division.

OSBORN

DEZENDORF

TERRELL

Osborn began his career with General Motors in 1917. He was named a GM vice president and general manager of the Electro-Motive Division in 1943. Dezendorf became director of sales for the Electro-Motive Division in 1945. Terrell became administrative assistant to the general manager in 1958.

PERSONAL BRIEFS

Robert W. Hodge has been named assistant manager, industrial sales, general office at Public Service Electric & Gas Co. **George Clarkson** has been promoted to senior rate assistant; **Robert W. Lockwood** to industrial representative, Perth Amboy; and **Thomas J. Brennan** to industrial representative, Orange.

Omaha Public Utility District has given assignments of supervisory responsibility within the Transmission and Distribution Division to **George B. Foot** and **Lloyd C. Shalla.** Foot, assistant superintendent of the division, will have operation of the line department, underground department, and transportation department. Shalla, assistant superintendent of the division will be responsible for operations of the substation department, service department, meter department, system protection department and line dispatching.

Walter J. Lyman, Duquesne Light Co, has been elected president of the Pennsylvania Electric Assn. **G. R. Parry,** Metropolitan Edison Co; **Park R. Lawson,** Pennsylvania Electric Co; and **P. M. Alden,** Philadelphia Electric Co, were elected vice presidents of the association.

Philadelphia Electric Co has made the following promotions: **Edward W. Carson** to manager of service operations department; **A. Lewis Parry, Jr.,** to superintendent of building management division; **Benjamin C. Czarkowski** to general supervisor, telephone division; **Herman O. Kuhnle** to buyer, purchasing department; **Victor T. Roth, Jr.,** engineer T & D department, curator of the Philadelphia Electric Co Historical Collection; **Albert E. Kremer,** assistant manager of the service division, residential and commercial

"AWRIGHT, WHO GOOFED?"

When that new substation is delayed for lack of switchgear or connectors, somebody's on the spot. Whenever delivery is an important factor, be sure . . . call Royal *first!*

Royal's compact operation is purposely kept flexible so each order gets custom service and *delivery when needed.* Every one of our customers get the "Royal treatment". . . it's a pledge we live by.

Whether your job is normal or rush, large or small, you'll like dealing with Royal—for switchgear, any of 5,000 standard connectors, or specially engineered designs. Save time and trouble—order from Royal.

For handy, on-the-spot information of Royal products, write for Bulletins on Type RVL Air Break Switch, Standardized Substations or Aluminum Power Connectors.

ROYAL

ROYAL ELECTRIC MANUFACTURING CO., INC.
1122 EAST 87TH STREET • CHICAGO 19, ILLINOIS
Designers and Manufacturers of
Power Switching Equipment and Special Electrical Devices

sales department; and **Thomas J. Roan, Jr.,** supervisor, commercial service section.

Joseph W. Kling has retired as manager of the public relations department of Georgia Power Co. The p.r. department will now be called the advertising department and **Warren Bateman** is manager. **William L. Westbrook** has been named Atlanta division manager and **Sam F. Lambert,** division superintendent. **A. H. Wade, Jr.,** has been made manager of the newly created general services department; **R. E. L. Shirley,** assistant to the vice president and general manager, and **W. F. Poole** to field supervisor of distribution. **Fred Kelly, Jr.,** has been made manager of the company's Pelham office; and **Donavon G. West,** safety engineer in the Atlanta headquarters.

Walter F. Schmidt has been promoted to construction foreman of Toledo Edison Co. **Marvin W. Keck** has been named design staff engineer.

William J. Bennett has been promoted to right-of-way man at Public Service Electric & Gas Co.

Otis G. Lankford has been appointed local manager at Union Springs for Alabama Power Co.

Union Electric Co has named **Charles W. Blood** communications supervisor in power supply and communications.

Harold L. Gerrish, for 30 years on the staff of Maine Public Utilities Commission, has become associated with the consulting engineering firm of William S. Leffler Engineers Associated, Darien, Conn.

Richard C. Scott has been appointed director of staff engineering by Dresser Electric Co.

Federal Pacific Electric Co has named **Clifford E. Harris,** division manager; **John S. Messer,** executive consultant; and **John W. Muse,** division marketing manager. Harris and Messer had been vice president and president, respectively, of **Economy Fuse & Manufacturing Co**

(*Continued on page* 117)

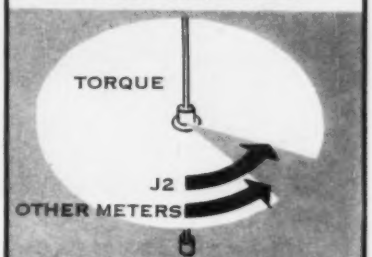
METERMAN'S CHECK LIST

Get Sustained Accuracy Even as System Capacity Grows

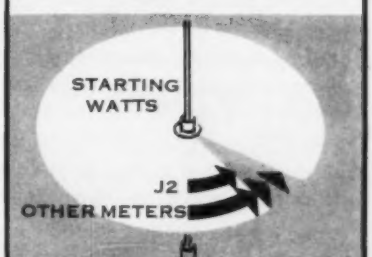
Sangamo J2 Watthour Meters provide the long-life accuracy that is so essential as test intervals lengthen and residential loads increase. Uniform load curves from 1.5 through full 200 amperes prove the J2's sustained, "straight line" accuracy on both light and heavy loads.

The J2, with its slow speed, exceptionally high torque, and ability to begin measuring on fewer starting watts than other meters, provides unexcelled extended range metering for all services, present and potential.

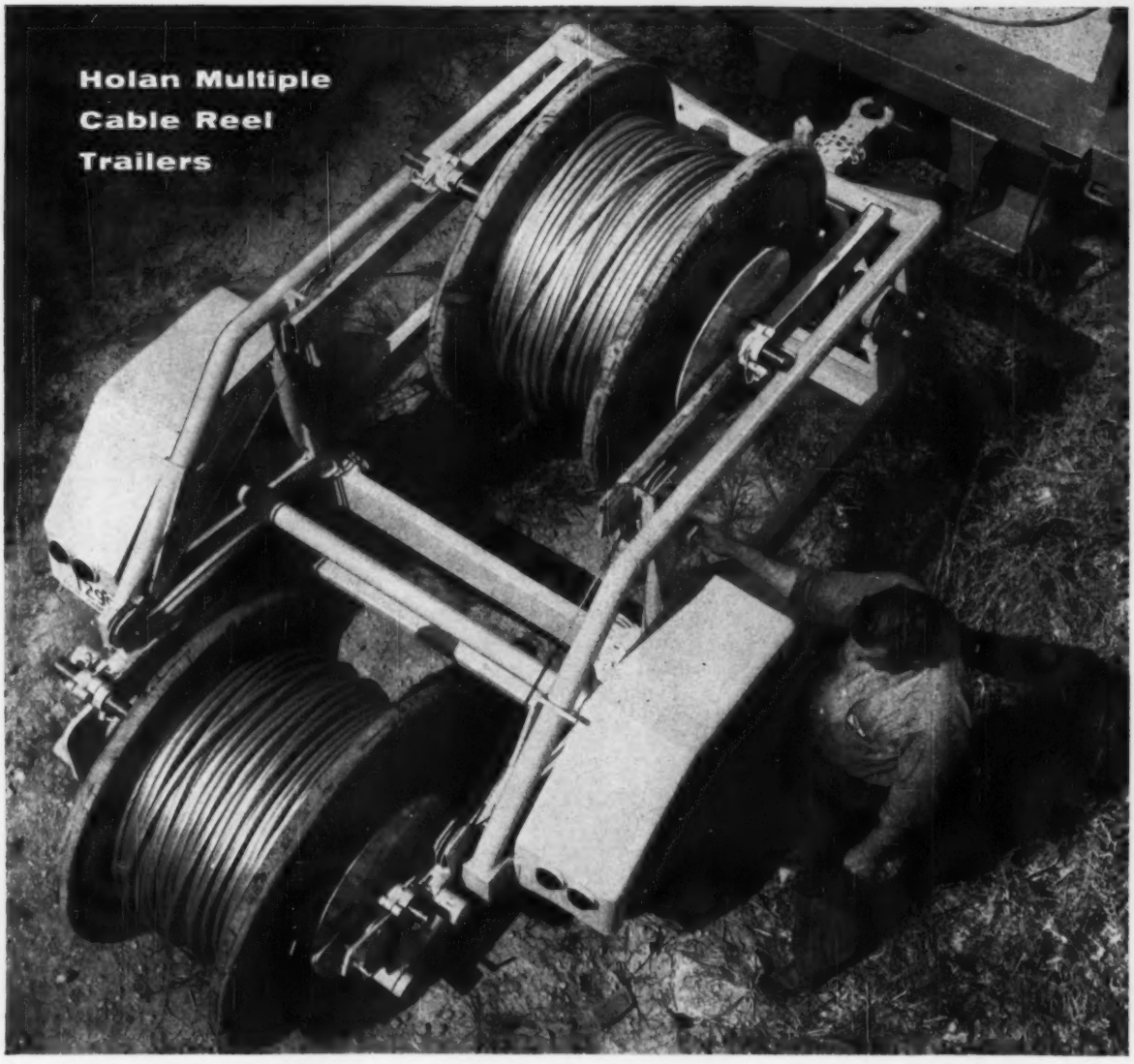
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS



UP TO 15% MORE TORQUE



UP TO 25% LESS STARTING WATTS



Make reel loading a one-man job

One man can load two cable reels and be on his way in three minutes with a Holan Multiple Reel Trailer.

Such speedy handling of heavy reels of cable by one man is possible because of simple, safe, functional design and a patented loading device.

Holan offers a complete line of 1-, 2-, 3-, and 4-reel trailers —all incorporating the same design features that assure safe, fast, economical operation by one man.

Pickup arms lower to within 12″ of the ground, handle reels as small as 24″ and as large as 54″ without any special attachments and without any heavy lifting by the operator.

A pushbutton controlled electric winch or hand winch lifts the reel into place. Both are located away from the hoisting mechanism, thus assuring that the operator stands clear of the reel while loading and unloading.

The electric winch is designed to prevent overloading of the lifting cable—even if the operator continues to apply power after the lift arms have reached maximum height. Reels roll freely to forward positions on spindle bars of sufficient length to support them in the event careless handling should cause the reels to shift from side to side or out of square.

Exclusive 22″ electric disc brakes eliminate overspin, give positive braking action, and provide tension for reconductoring.

Write today for your copy of the Multiple Cable Reel Trailer brochure—or ask your Holan Field Representative for the facts that prove reel handling can be a one-man job.

Holan Corporation, 4100 West 150th St., Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

(*Continued from page* 115)

which Federal Pacific acquired last January.

Electro-Motive Division, General Motors Corp, has made the following appointments: **William H. Harvey** to director of production; **B. B. Brownell** to director of engineering and research; and **Thomas B. Dilworth** to chief engineer.

William J. Hagan III, has been appointed director of electrical conductor sales of Southern Electrical Co.

Theodore E. Casselman, Jr., has been named manager of the New York office of Stone & Webster Engineering Corp.

Joseph S. Busch, former senior engineer for Westinghouse Electric Corp's Bettis Plant, has been named head of the core analysis and test section for Atomic Power Development Associates, Inc.

Robert B. Walsh has been named personnel manager by S&C Electric Co.

R. E. Lander has been made project engineer in the investigation, standardization and improvement department at Keasbey & Mattison Co. **Albert W. Spedding** has been named chief project engineer in the Central Engineering Division.

George A. Hildebrand has been appointed administrator, micromodule and rectifier sales, Radio Corporation of America, Semiconductor and Materials Division.

Kaiser Aluminum & Chemical Corp has named **Gillette N. Houck** assistant to the manager of the Electrical Conductor Division, and **Cecil R. Pickens,** division technical manager.

D. B. Oldaker has been appointed superintendent of maintenance of Monsanto Chemical Co's Inorganic Chemicals Division engineering department, and **W. C. Sullivan** has been named engineering supervisor for Monsanto.

International Business Machines Corp has appointed **Benjamin H. Askew** assistant to the treasurer and **Dr. Curry W. Gillmore** director of statistics and economics. **Dr. James R. Killian, Jr.,** chairman of the corporation, Massachusetts Institute of Technology, has been named a director of IBM. **Robert W. Hubner** has been made executive assistant to the president, succeeding **Walter H. Johnson** who has been named director of product planning on the corporate staff.

Allis-Chalmers Mfg Co has appointed **Russell A. Hedden** works manager of manufacturing, Industries Group. He succeeds **E. W. Bonness** who has been named consultant to the director of manufacturing.

Samuel P. Soluri has been appointed manager of the engineering design branch of Carborundum Co.

Emerson Electric Manufacturing Co has elected three executives advisory members of the board of directors. They are: **Edward L. O'Neill,** vice president and general sales manager; **William L. Davis, Jr.,** vice president of engineering. **Charles G. Gulledge,** vice president of Electronics & Avionics, has also been elected a member.

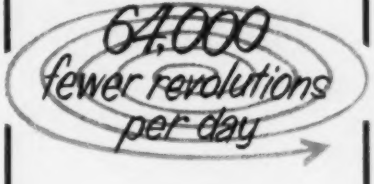
Hubbard & Co has appointed **Douglass S. List** product manager to supervise the marketing of its new line of fuse cutouts. **Don Burland** has been appointed manager of production control at the Cicero, Ill., plant, and **Harold W. Luce,** application engineer for lightning arresters in the protection equipment department.

General Electric Co has made **Joseph Horvath, Jr.,** manager of apparatus sales office in Augusta, Maine, succeeding **H. W. Murdock** who retires after 35 years of service. **James P. O'Neill** has been appointed director of sales training for the sales and distribution department, major appliance division, New England district. Three appointments in the large steam turbine-generator department are: **Charles H. Holley,** manager-generator product engineering; **Edson D. Huntley,** generator electrical engineer; and **W. J. Gilson,** supervisor-generator requisition, proposition and maintenance engineering.

METERMAN'S CHECK LIST

Get Consistent Overload Accuracy and Reduced Wear

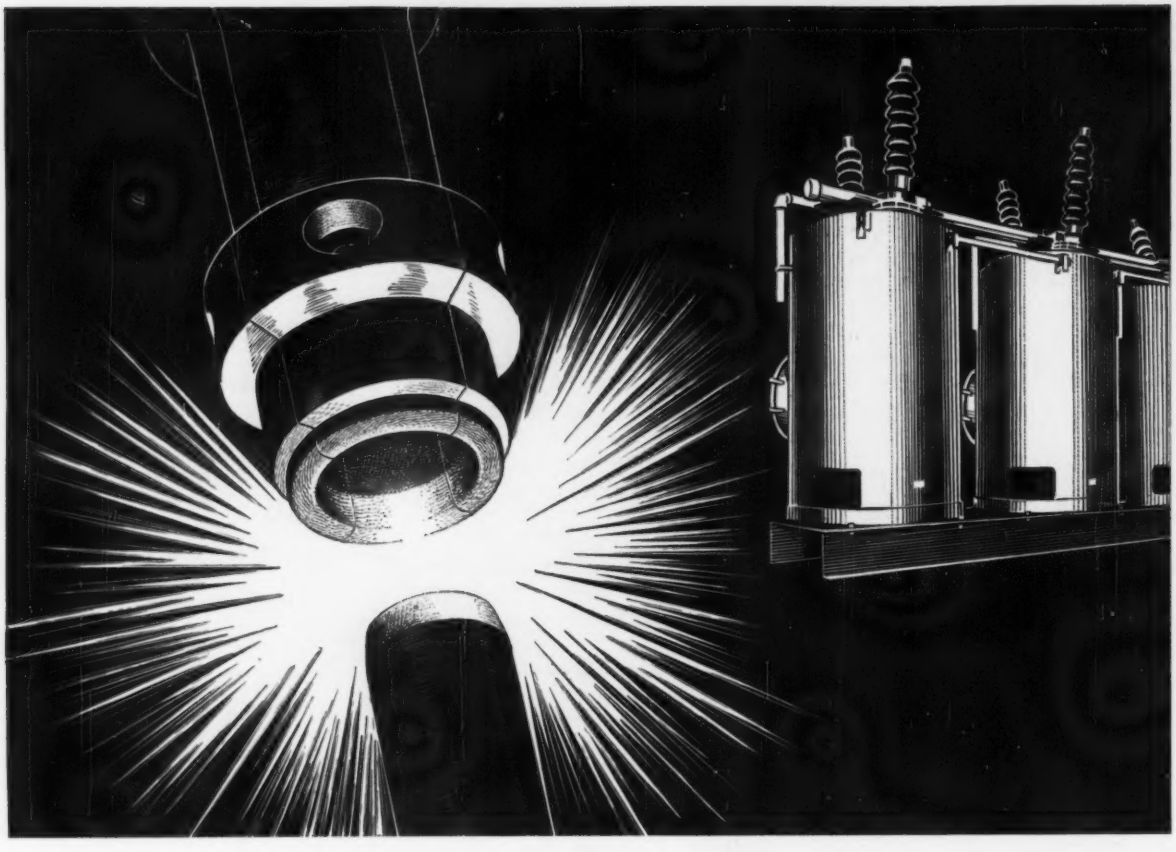
Sangamo J2 Watthour Meters are the only meters that match slower disk speed with increased overload capacity. The result: more uniform load curves, and reduced wear on all moving parts, fewer repairs and replacements, longer meter life, more economy.



In one day, the disk of a conventional Class 100 meter operating at full capacity makes 160,000 revolutions. The J2 makes 64,000 fewer. Actually, the J2 makes only 10 revolutions per minute at full name-plate rating. That's a full 40% slower than any other meter.

SANGAMO Electric Company

SPRINGFIELD, ILLINOIS



Be Sure of Service By Specifying Elkonite® Contacts

There's a difference in contact materials . . . and the difference means a lot in the service you get from the equipment you buy. Extra performance in repeated making and breaking high-current circuits, in voltage regulators, circuit breakers, motor controllers and similar equipment, demands extra know-how in the development and manufacturing of contacts.

And that's what you get with Mallory Elkonite® contacts. These unique materials are the result of long experience by Mallory in applying special powder metallurgy techniques to combine refractory and conductive metals. For each circuit-breaking application, our contact specialists can control such factors as refractory particle size and methods of pressing and sintering to produce the optimum combination of hardness, strength, density, arc erosion resistance and electrical conductivity for the intended use.

Leading manufacturers have been using Elkonite® for many years, because they know the extra value and performance that Mallory engineers into them.

To make sure that your switchgear gives you top service, tell your supplier you want Elkonite® contacts.

Mallory Metallurgical Co., Indianapolis 6, Ind.
a division of

P. R. MALLORY & CO. Inc.
MALLORY

Serving industry with these products:

Electrochemical
- Capacitors
- Batteries
- Resistors

Electromechanical
- Switches
- Control Devices

Electromagnetic
- Vibrators
- Relays
- Choppers

Electronic Assemblies
- Power Supplies
- Tuning Systems

Metallurgical
- Contacts
- Powder Metallurgy Materials
- Welding Materials
- High Density Metals

Semiconductor
- Silicon Rectifiers

T&D Group Reports Computer Use

(*Continued from page 55*)

C. E. Bathe, Oklahoma Gas & Electric Co., said the proposal is not liberal enough. He objected to the provision requiring special approval by local utilities of installations where locked rotor currents exceeded 150 and 300 amp for single and 3-phase motors. In effect, he said this rule favors 3-phase compressor motors and would tend to make single-phase units disappear, as manufacturers would not risk disapproval of their units.

T. C. Duncan, chairman of the EEI-NEMA Joint Committee on Higher Secondary and Utilization Voltages, summarized results of a questionnaire seeking industry opinion regarding the three proposed higher secondary voltages submitted by the committee in January of 1959. Of the 33 responding companies, 29 approved the 240/480-v single-phase proposal, 19 the 240/416Y v proposal, and 17 the 265/460Y as an alternative for industrial and commercial application, Duncan said. About half the membership of the T&D Committee responded to the questionnaire. The Joint Committee proposal has not yet been approved by NEMA.

Hugh Lawyer, Oklahoma Gas & Electric Co, reported that his company's use of kwhr values for estimating loads on system components is being extended to all customers beginning in the summer of 1960. Although this method of load determination was originally applied as a manual method, it is readily adaptable to modern machine data processing methods which can produce considerable additional information, Lawyer said.

Frank Tulloch, Boston Edison, substituting for Chairman Dan Campbell, indicated that the storm-tracking procedure instituted by the EEI Task Force on Mutual Assistance Coordination Among Utilities, successfully tracked hurricane Gracey, from the time it hit the South Carolina Electric & Gas system near Charleston, noon September 29, until 5 pm when it hit Columbia, S. C., with somewhat diminished force.

Short circuit at tests on 5 and 15-kv spacer cable conducted at the Line Material Industry's Laboratory were shown to the committee in a film presented by David C. Ward, John A. Roebling's Sons. The tests demonstrated that both 5 and 15-kv cable spacers withstand electromagnetic forces generated by currents up to 10,000 amp symmetrical for four cycles even at ambient temperatures as low as OF. For small conductor sizes, the short circuit limitation is determined by the thermal capability of the insulation. For larger conductors, the short-circuit limitation is the strength of the spacer clamp.

System & Equipment Group Sees Lag in Recruiting

(*Continued from page 55*)

Missouri utility. During its four years of operation, the system has proved to be versatile and reliable and has demonstrated ability to perform a rapid and accurate regulating function. He noted, however, that system complexities and limitations preclude the attainment of maximum operating economy. But the resulting reduction in total fuel more than offsets carrying charges on the installation.

Successful operation with an "electronic sentry" capable of monitoring selected functions at an unattended substation was reported. The device reports alarm conditions automatically over an ordinary dial telephone to a central point. It was described by Wesley C. Baylis, Niagara Mohawk Power Co.

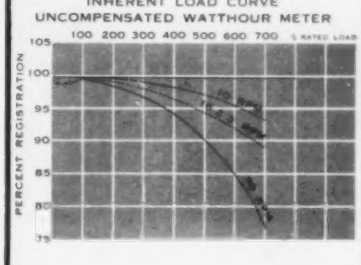
C. A. Sloan reported that Kansas City Power & Light Co has analyzed the use of aluminum bus in a 161/13.2-kv substation. The study concentrated on the use of tubular cross bus about a strain type low bus supported largely by switch racks. The construction required 14,000 lb less steel and 30 yd less concrete than comparable all strain bus construction, he said.

METERMAN'S CHECK LIST

Greater Overload Capacity With Less Compensation

The Sangamo J2 Watthour Meter needs less compensation for "straight-line" accuracy. Its individual overload curves are more uniform, too.

These built-in "plusses" come from the J2's slow, 10 revolutions-per-minute disk speed. Check this: current damping, which varies directly with the current flux squared and the disk speed, causes the phenomena of reduced registration on higher loads. With a slow speed J2, current damping plays a smaller role in overload accuracy.



As can be seen from the curves on the graph, the inherent load curve of an uncompensated 10 rpm meter is substantially better than meters with higher speeds. The slow speed of the J2 also reduces wear on moving parts.

SANGAMO Electric Company
SPRINGFIELD, ILLINOIS

Move Slowly to Selective Testing . . .

. . . joint meeting of AEIC and EEI Meter Committees told. Each utility should fit a plan to its individual system

Don't codify plans for the selective testing of meters too soon, metermen were warned at a recent meeting at Portsmouth, N. H. The audience was the combined Meter & Services Committees of the Association of Edison Illuminating Companies and of the Edison Electric Institute.

Actual performance of sample testing plans should be evaluated in many situations, said L. H. Newman, Ebasco Services. Different meter types, he added, may need special consideration to fit them into any permanent plan. Each utility should fit its plan to its own record system and physical layout for best efficiency, he said.

Available meter records do not always suffice for the selective sampling program, declared L. J. Beckwith, Wisconsin Electric Power Co. A survey, he said, has shown that some record systems do not include meter locations. Either this information must be added to such records, or a more acceptable sampling system must be developed, utilizing only existing information.

J. S. Lineback, Cincinnati Gas & Electric Co, said that automatic meter reading remains a long-range objective. Although interest in automatic reading is extensive, he said, citing a survey, a system must yet be developed which could compete with present reading practices costing up to $2.14 per meter per year.

The meeting voted 4-to-1 against extending use of metering transformers to non-metering loads, such as relaying, temporary graphic instruments, and capacitor control. At 66 kv and higher, however, the majority of company representatives said they would permit non-relaying loads. About a quarter of those present would allow serving relays as well, with accuracy corrections being made to the meters if necessary.

Several conferees opposed the outdoor storage of outdoor-type instrument transformers. Such storage, they said, brought on troubles due to moisture. But tests cited by F. H. Rogers, Baltimore Gas & Electric Co, show that such units dry out satisfactorily when moved indoors and energized for a time before installation.

Ultrasonic cleaning is increasing in meter shops. Seven utilities reported its use on demand attachments; two on glass covers. Users reported general satisfaction.

It took 29 yrs. research to make
JAQUES hydraulic
HOLE DIGGERS
Fastest, Strongest, Safest
most economical!
Time-and-money-saving features of Jaques All-Hydraulic Hole Diggers took 29 years to develop. Rugged, versatile Jaques TJ-254 mounts on standard trucks, drills holes up to 48" diameter, to 25' depth, in hardest soil or rock — FASTER, CHEAPER, EASIER than competitive machines! Fewer moving parts insures minimum down-time, maintenance, operating costs. Shock-resistant device relieves strain in rock digging. Simple to operate with only 3 primary adjustments. FREE DEMONSTRATION WILL PROVE THESE CLAIMS!!
Jaques TJ-254 digging at 30-degree angle. Operates at up to 45 degrees.
FREE
TEXOMA ENTERPRISES, INC.
HIGHWAY 75 North, SHERMAN, TEXAS
Send me FREE detailed literature.
Have representative call. No Obligation.
NAME
TITLE
ADDRESS
CITY
STATE
TEXOMA ENTERPRISES, INC.
HIGHWAY 75 NORTH • SHERMAN, TEXAS

Epoxy Resin Cuts Motor Maintenance

(*Continued from page* 69)

tion was applied to the main generators for diesel locomotives. When the system was put in production at the railroad's Altoona electrical repair shops it was found to be significantly cheaper to apply than conventional insulations.

The system has been adopted as standard for the PRR's 2,710 heavy-duty diesel and electric locomotives. As they come into the shops for repairs, motors and generators are being converted. About 900 motors and 68 main generators have been put in service with the new components without a failure.

Engineers expect that the insulations will last 5 to 10 years or longer. Previous insulations needed overhaul after three years.

Do We Have Your *Complete* Address?

Not unless you included your postal zone number when moving, subscribing or renewing subscriptions.

CONSTRUCTION OF THE LABORATORY OF THE
INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
ORGANISMO INTERNACIONAL DE ENERGIA

U. S. GIFT of $600,000 will cover construction costs of IAEA laboratory at Seibersdorf near Vienna. Cole, right, describes the project to Dr Henry Seligman, his deputy director general, division of research and isotopes

IAEA Takes Realistic Approach

(*Continued from page* 53)

construction cost of nuclear plants. The price per installed kw is expected to average $410 in 1961 for a natural-uranium plant, the OEEC report said. This price would drop to $335 in 1962, to $310 in 1963-4, about $290 in 1965-6, and $280 in the 1967-70 period. The cost per kw in plants using enriched uranium is expected to drop from between $385 to $480 in 1961 to about $280 to $360 by 1970.

John A. McCone, chairman of the U. S. Atomic Energy Commission, invited the IAEA to participate in the AEC's project to build a 20-Mw pressurized-water power reactor. The U. S. he said, "is prepared to work out with the agency agreements under which the agency's technical personnel can participate in this project from design stage, through reactor construction, startup and operation." In addition, McCone promised the agency information on the Elk River, Minn., and Piqua, Ohio, nuclear projects.

The U. S. again pledged to pay substantial portion's of the IAEA expenses. This includes half of the $1.5-million operational (Type B) fund—$500,000 of it unconditionally and the other $250,000 as a matching contribution once the $1-million mark is reached. The U. S. again will pay 32.51% of the assessed (Type A) budget. After a gift last year of two mobile laboratories costing $73,000, the U. S. donated an additional $600,000 for a laboratory near Vienna.

Delegates at the two-week session were greatly interested in the Westinghouse Electric Corp announcement on its readiness to build three plant sizes ranging in cost from $28.3 million to $72.4 million and generating power for a uniform 7.3 mills/kwhr.

Data on small and medium-size reactors prepared by two of the U. S. manufacturers most interested in this field have been transmitted to the IAEA staff. A U. S. engineering firm with broad experience in conventional and nuclear power plants has prepared a study of small reactors which has been made available to the agency. The Oak Ridge National Laboratory's preliminary report, comparing small and medium-size plants of the boiling-water, pressurized and organic-moderated types, also has been given to the IAEA.

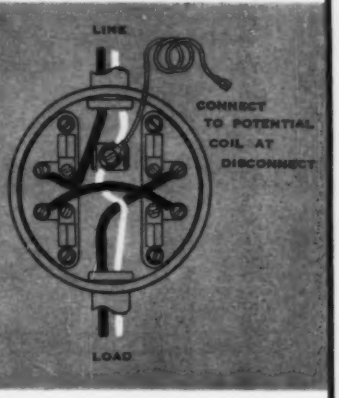
It will be up to other advanced countries now to do likewise. The

(*Continued on page* 123)

METERMAN'S CHECK LIST

Protect Today's Investment in 2-Wire Services

Sangamo J2 Watthour Meters are designed so that standard 3-wire meters can be installed on 2-wire service by simple socket connections.



All connections are external, make conversion from 2-wire to 3-wire service simple. The same meter is used for the new 3-wire service; there are no returns to the shop for conversion. The J2 eliminates the need to retire meters before their time, protects investments in 2-wire services, reduces and simplifies stock inventory.

SANGAMO Electric Company
SPRINGFIELD, ILLINOIS

PROFESSIONAL SERVICES

CONSULTING · DESIGN · EXAMINATIONS · APPRAISALS
CONSTRUCTION · PLANS · SURVEY · REPORTS

AMERICAN AIR SURVEYS, INC.
- Aerial Topographic Maps & Photos
- Plan & Profile for Transmission Lines
- Aerial Stereo-photos for Planning
- Topographic Maps for Reservoir Studies
- Coal Stockpile Volumes by Aerial Method

A NATIONWIDE SERVICE
907 Penn Avenue — Pittsburgh 22, Pa.

BLACK & VEATCH
Consulting Engineers
Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates
1500 Meadow Lake Parkway — Kansas City 14, Mo.

THEODORE D. BROSS LINE CONSTRUCTION CORP.
Steel Tower & Wood
Transmission Lines
Distribution & Maintenance
175 Endfield St. — Hartford, Conn.

BURNS and ROE, Inc.
Engineering and Design • Reports • Surveys
Construction • Electric, Steam, Hydro Plants
Transmission • Distribution • Aeronautical
Facilities • Research and Development • Nuclear, Chemical, and Industrial Plants
160 West Broadway • New York 13, N. Y.

COMMONWEALTH SERVICES INC.
Management and Business Consultants
300 Park Ave.
New York 22, N. Y.

ASSOCIATES INC.
Consulting and Design Engineers
209 E. Washington
Jackson, Michigan

DAY & ZIMMERMAN, INC.
Engineers
Design—Construction
Transmission—Distribution Lines
Reports—Valuations—Rates
New York — PHILADELPHIA — Chicago

DOBLE ENGINEERING COMPANY
Electrical Insulation Engineers
Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications
Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr., Chicago, Ill.

ELECTRICAL TESTING LABORATORIES, INC.
Electrical, Electronic, Environmental, Photometric and Chemical Laboratories. Testing, Research, Inspection and Certification.
2 East End Ave. — New York 21, N. Y.

GIBBS & HILL, Inc.
Consulting Engineers—Designers—Constructors
Steam, Hydroelectric, Gas-Turbine & Nuclear Power Generation—Electric Transmission & Distribution Systems—Power Surveys, Reports & Contracts—Industrial, Transportation & Communication Facilities—Water & Waste Treatment Works.
Los Angeles — NEW YORK 1, N. Y. — Tampa

GILBERT ASSOCIATES, INC.
Engineers and Consultants
DESIGN
SUPERVISION OF CONSTRUCTION
BUSINESS AND ECONOMIC RESEARCH
READING, PA.
Washington — New York

HARZA ENGINEERING CO.
Consulting Engineers
Calvin V. Davis — E. Montford Fucik
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development
400 West Madison Street — Chicago 6

HOOSIER ENGINEERING COMPANY
Erection and Maintenance of Electrical Transmission and Distribution Lines
1354 Holly Avenue, Columbus, Ohio

JACKSON & MORELAND, INC.
JACKSON & MORELAND INTERNATIONAL, INC.
Engineers and Consultants
Electrical—Mechanical—Structural
Design and Supervision of Construction for Utility, Industrial and Atomic Projects
Surveys—Appraisals—Reports
Machine Design—Technical Publications
Boston — Washington — New York

JENSEN, BOWEN & FARRELL
Engineers
Appraisals—Depreciation Studies—Property Records
Cost Trends—Special Studies—Reports
for Rate Cases, Security Issues, Regulatory and Accounting Requirements
Michigan Theatre Building Ann Arbor, Michigan
NOrmandy 8-7778

THE KULJIAN CORPORATION
Engineers - Constructors - Consultants
POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)
Utility • Industrial • Chemical
1200 N. Broad St., — Philadelphia 21, Pa.

PETER F. LOFTUS CORPORATION
Design and Consulting Engineers
Electrical • Mechanical • Structural
Civil • Nuclear • Architectural
First National Bank Building
Pittsburgh 22, Pennsylvania

CHAS. T. MAIN, INC.
Engineers
Electric, Steam and Hydraulic Projects,
Investigations, Reports, Appraisals
Design and Construction Supervision
Boston, Mass. — Charlotte, N. C.

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers..Purchasing Specialists in Financing Accounting and other Operations
231 So. La Salle St. — Chicago 4

SARGENT & LUNDY
Engineers
140 South Dearborn St.
Chicago, Ill.

TIPPETT & GEE
Consulting Engineers
Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process
1323 North Second Street — Abilene, Texas

UTILITIES LINE CONSTRUCTION COMPANY, INC.
Construction and Maintenance
Transmission - Distribution
Electric and Telephone Lines
Consultants
505 York Road — Jenkintown, Pa.

VERNON GRAPHICS, INC.
Mount Vernon, N. Y.
MO 4-7117

VERNON GRAPHICS OF PA. INC.
Norristown, Pa.
Broadway 3-3600

CONSULTING AND SERVICING UTILITIES ON MAPS, RECORDS AND FIELD INVENTORY

READERS MAY CONTACT

the consultants whose cards appear on this page with the confidence justified by the offering of these special services NATIONALLY.

Cost Range for Reactors in Less Developed Countries

(in mills per kwhr)

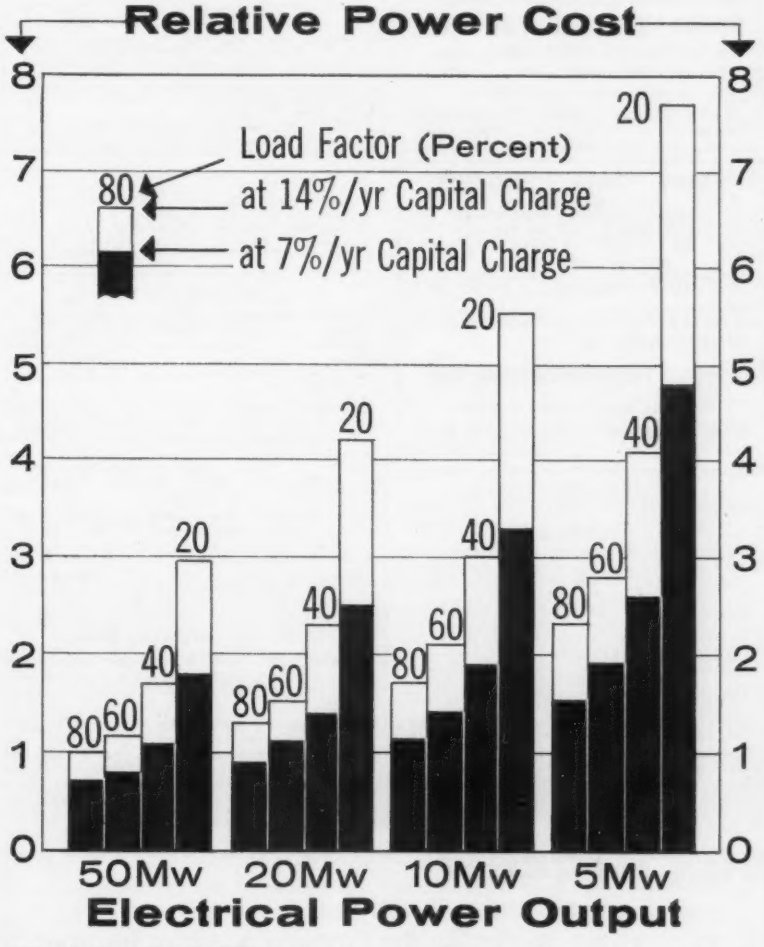
Type of Cost	Natural Uranium		Enriched Uranium	
	At $300/kw	At $400/kw	At $280/kw	At $350/kw
Financial charges	3.6– 7.3	4.9– 9.8	3.4– 6.8	4.3– 8.6
Fuel	2.5– 3.3	2.5– 3.3	3.1– 4.3	3.1– 4.3
Operation	0.6– 1.0	0.6– 1.0	0.6– 1.0	0.6– 1.0
Insurance	0– 0.4	0– 0.4	0– 0.4	0– 0.4
Total	6.7–12.0	8.0–14.5	7.1–12.5	8.0–14.3

IAEA Takes Realistic Approach

(*Continued from page* 121)

agency seeks facts and figures on overall economics, power supply, growth rates, industrialization and capital actually existing from each participating country.

The IAEA, headquartered in a politically neutral country, seems to be the logical focal point for the information. The publishing of the "World Power Reactor Guide" by the agency has been a beginning in presenting technical information. The big job ahead is the extrapolation of data from the conditions in advanced countries to those applicable power reactors to be constructed in countries which are less developed.



PRELIMINARY INDICATIONS of nuclear power generation's relative cost indicates the variations with reactor output, load factor and annual capital charge

METERMAN'S CHECK LIST

Sectionalized Meter Construction Means Lower Costs

Sangamo J2 Watthour Meters are designed to perform indefinitely without maintenance. When, rarely, a J2 needs minor repairs, the job is simple. The J2 is constructed with easy-to-assemble units. Any component can be inspected or replaced without completely disassembling the meter.

Position and alignment of the disk and magnet always remain the same, and the register is properly located with simple locking levers. And, it's a snap to calibrate the J2 when it is reassembled. This ease of service means lower labor costs.

SANGAMO
Electric Company
SPRINGFIELD, ILLINOIS

TRANSFORMER ENGINEERS

Rapidly expanding manufacturer of dry type and liquid-immersed distribution and power transformers has excellent opportunity for one electrical and one mechanical engineer.

Both engineers should have several years experience in their respective fields. Their duty will be the design and development of new lines of transformers and various transformer components.

Both positions offer great opportunity for advancement.

Send resume to

PRECISION TRANSFORMER COMPANY

2218 W. Lake St. Chicago 12, Ill.

SEeley 8-2906

PRESIDENT

Our client seeks top management executive for position of president and chief executive officer of major company in a regulated industry.

This man should be:

- Age 40 to 45
- Experienced in financial negotiations and preferably with some exposure to governmental regulatory problems.
- An executive with proven administrative and organization ability, presently earning over $30,000.
- Service oriented, civic minded.

All replies treated in strict confidence.

Box P-2893—Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

WANTED

RELAY TEST ENGINEER

Excellent opportunity in relay test section of Massachusetts utility. Good knowledge of electronics a necessity. E.E. degree helpful. Salary commensurate with experience. Write resume of experience, education, personal data, and salary requirements. All held in strict confidence.

P-2448, Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36,N.Y.

TRANSFORMERS

3—2500 KVA G-E 69000—2300Y
3—2500 KVA G-E 69000—2400/4160Y
3—2500 KVA G-E 69000—7200/12470Y
4—2500 KVA W-H 34500—2400/4800
3—1500 KVA G-E 69000—2300Y
3—1500 KVA G-E 69000—2400/4160Y
3—1500 KVA G-E 69000—7200/12470Y
4—1000 KVA Mol 7200/12470Y—4160
3—333 KVA W-H 67000/69000—240x480
3—333 KVA G-E 66000—2400/4160Y
1—750/938 KVA G-E 3-Ph. 33000—6900Y—TCUL equip. fan cooling
1—1000 KVA W-H 3-Ph. 33000—7200Y TCUL equipped

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.

5316 Hetzel St.
Cincinnati 27, Ohio

47 Years' Dependable Service

SHUNT REACTOR FOR SALE

W'hse Type OA 69000 Volts 3 Phase 5000 KVA Self cooled. Oil in excellent condition. Full data available.

NORTHWEST IOWA POWER COOPERATIVE
Box 1011 Le Mars, Iowa

LARGE POWER EQUIPMENT

Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL-3-3334

WHO'S WHO in —

Electrical Equipment Representatives

Write for copy of EERA Directory

C. W. SWARD, Executive Director EERA
1675 Fifth St. Clermont, Florida

OFFICIAL PROPOSALS

Bids: November 30, 1959

Tenders

Tenders are invited for the supply of all or any of the following items of equipment:

(a) Two (2) Electrically driven Pumps 1000 IMP. g.p.m. 50' head.
(b) Two (2) Electrically driven Pumps 1000 IMP. g.p.m. 150' head.
(c) One (1) Transformer 1,250 KVA, 33,000/415V, 60 cycles.
(d) One (1) Liquid earthing Resistor, 33,000 V, A/C 20 ohms, 30 sec. rating.
(e) Paper insulated multicore cables 660 and 1100 V.
(f) One (1) only 65/70 tons load Railway Well-Wagon. New or re-conditioned.

Specifications and drawings may be obtained on application to the Purchasing Officer, Trinidad and Tobago Electricity Commission, P. O. Box 121, Port of Spain, Trinidad, W. I. Closing date for Tenders November 30, 1959.

ELECTRIC UTILITY DIVISION VICE PRESIDENT

Major electric utility company has an opening for an operating executive to fill the position of Division Vice President. This key management position will encompass full responsibility for company operations and development activities in a relatively large geographical region which has substantial growth opportunities. The position requires a college graduate, engineering degree preferred; age 35 to 45; a personality geared to a service operation; strong administrative ability; and operating managerial experience. Previous experience in a service organization involving contact with governmental controls is desirable.

In replying please include complete resume. All replies will be kept confidential.

P-2885, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

Wanted—UTILITY ENGINEER

Electrical and Water Departments. Supervisory and Administrative ability essential. Resume of education and experience required. Address applications to:

Town of Greendale, P.O. Box 269
Lawrenceburg, Indiana

ELECTRICAL DESIGNERS

Require men experienced in designing conduit plans, cable systems, physical layouts, wiring diagrams, lighting systems, and other electrical features of hydroelectric powerplant design. Detailing and checking experience primary requirement. Send resume to Mr. James E. Collins, Personnel Manager.

Harza Engineering Company
400 W. Madison St., Chicago 6, Illinois

ADDRESS BOX NO REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Wanted—Graduate Electrical Engineers— Electric Utility in North Jersey area. Some experience in transmission and distribution desired. Please answer giving education, experience and salary expected. P-2345, Electrical World.

Electrical Engineer. Electrical Engineer with High Tension experience to manage Engineering Department for a manufacturer of Porcelain Insulators. Position includes full responsibility for design, testing and development of electrical porcelain. Replies confidential. P-2857, Electrical World.

Sales Manager—Fans—Manufacturer of mechanical draft fans looking for me. Experienced all phases fan design and selling for administrative position with unlimited opportunities for salary and management growth. Send resume and salary requirements. P-2910, Electrical World.

SELLING OPPORTUNITIES OFFERED

Representative wanted for manufacturer of street lighting equipment pole line specialties. Full particulars. RW-9821, Electrical World.

Manufacturer's Agent—To represent old, established manufacturer of high tension, wet process electrical porcelain specialties (no standard insulator line) in Eastern Pennsylvania, New Jersey, Metropolitan New York, Delawarer and Virginia. In applying, please give age and send recent photo. RW-2770, Electrical World.

DON'T FORGET

the box number when answering advertisements. It is the only way we can identify the advertiser to whom you are writing.

SEE's Course for Execs Hits a Popularity Peak

With only two months gone since the completion of the Southeastern Electric Exchange course for utility executives, demand for enrollment in next year's session at Georgia Tech already exceeds the supply.

This year, the Seventh Public Utility Executive Short Course had a class of 52 men representing 23 utilities in 12 states, the District of Columbia, Mexico and Brazil. About 20 more people had to be turned down because of space and faculty limitations.

The 1959 graduates were enthused over a new "Management and Society" course, which provoked much thought and discussion on the history and heritage of our ideas, and on the premise that management has responsibilities beyond the concern of an official's department or even his company.

The four-week course provided 84 hours of classroom instruction and 36 hours of problem solving, reading and research, and informal discussions in virtually all fields of utility management.

In addition to the faculty at Georgia Tech, instructors included A. J. G. Priest, University of Virginia; Dr Harry Guthmann, Northwestern University; Dr Paul Pigors, MIT; and William F. Ogden, General Electric.

AEC Schedules Hearings On Elk River and Piqua

The Atomic Energy Commission will hold public hearings next month to consider safety aspects of reactors planned at Elk River, Minn., and Piqua, Ohio. The hearings, slated for Nov. 10 and Nov. 20, respectively, are in line with new AEC policy to treat government-owned reactors under the second-round demonstration program the same as licensed private reactors.

The deadline for proposals from cooperatives and public power agencies for a small pressurized-water reactor was moved from Nov. 16 to Dec. 21. About 45 organizations already have indicated an interest in participating in the project, AEC said.

Stamp Issued for Aruba Sea-Water Process Plant

The importance of fresh water and electricity to Aruba, an arid island in the Carribean, was underscored Oct. 16 by the issuance of a new postage stamp. It depicts a line of the cast-iron evaporators in the 2.7-million gpd conversion plant, which also produces 12.5-Mw of marketable electricity. Described as the largest such plant of its kind, it has provoked world-wide interest in the sea water conversion process, which today is capable of producing fresh water for less than $1 per 1,000 gal, according to Singmaster & Breyer, Inc, designers and builders of the Netherlands West Indies project.

FPC Rings Up 'No Sale' On Central Vermont Deal

FPC has turned down a request by Central Vermont Public Service Co to sell 46 miles of transmission line to its subsidiary, Vermont Electric Power Co. If the sale had gone through, the line was to be used jointly by the two companies to buy and distribute power from the St. Lawrence project.

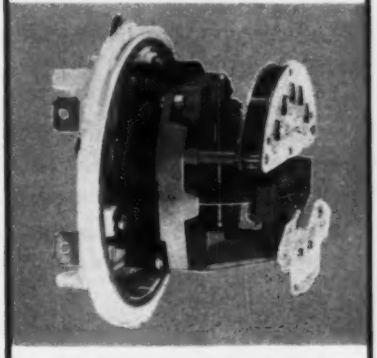
Central Vermont would have sold the line for $712,994, and would have paid VELCO $3,204 monthly rental for joint use of the line.

The commission, reversing an earlier presiding examiner's approval of the sale, said the proposed rental was inadequate and against the public interest. It also said that Central Vermont could operate the line as well as VELCO. The latter company, owned to a lesser degree by Green Mountain Power and Citizens Utilities, was organized to operate a grid in Vermont to distribute St. Lawrence Power.

METERMAN'S CHECK LIST

Stop a Meter Maintenance Problem... *CORROSION!*

The Sangamo J2 Watthour Meter has corrosion resistant construction designed to end maintenance problems caused by weather and atmospheric conditions.



The corrosion resistant finishes used on the J2 are the finest available, anywhere. But, they do change (for the better) because the search for ideal finishes is never-ending. Meters are tested under actual operating conditions in corrosive atmospheres even as Sangamo chemists develop new finishes. As a result of these tests and continuing chemical research, the corrosive resistant characteristics of the J2 meter are being improved constantly.

Get the whole story of the J2... It's told in an informative booklet titled "Meterman's Check List." Write for your copy today.

SANGAMO Electric Company

SPRINGFIELD, ILLINOIS

Tuition Supplements—

One Good Way To Help Our Colleges And Universities

The business community has made an impressive start in going to the desperately needed financial aid of our colleges and universities. Business contributions to higher education have increased from only $40 million in 1950 to $136 million in 1958.

This rise in financial aid to higher education should be a great source of satisfaction to the business community. But it goes only part way toward meeting the growing needs of colleges and universities for financial help. Over the next ten years business aid to our privately supported colleges and universities alone must increase to at least $500 million a year merely to provide decent faculty salaries and meet the increased operating costs of taking care of enrollments that will almost double.

One pervasive reason why many business firms have not joined the ranks of the companies contributing to higher education seems to be that, in the interest of prestige and public relations, they are making their provision of aid contingent upon finding some particularly novel way of providing it. So long as this point of view persists, business aid will lag, for there are simply not enough ways of providing financial aid that are both notably novel and sensible.*

How The Plan Works

There are, however, some well-tested ways of providing aid which improve rather than fade in appeal with more using. One such way is the making of supplemental tuition payments to colleges and universities at which a company's employees take courses.

Many companies have scholarship or tuition-refund programs which cover all or part of the costs to their *employees* of taking college courses. But, in most colleges and universities, tuition charges fall far short of covering the full cost of the education given. By making an unrestricted "cost-of-education" grant a part of their employee scholarship or tuition-refund plans, these companies could make a material contribution toward covering the *college's* full costs as well.

The tuition supplement can be a fixed amount or a percentage of the tuition charged. Some plans provide for supplements as high as 100% of tuition, though there is usually an upper limit to the total supplemental payment given for each employee enrolled in the institution.

The plan seems to have originated with the Ford Motor Company Fund. When we at McGraw-Hill first learned of it, it appealed to us as having so many advantages, and so few disadvantages, that we adopted it as one part of our own program of financial aid.

---

*The efforts of the McGraw-Hill Publishing Company to find a suitable method of aiding higher education prompted the writing of a "more or less Socratic dialog" entitled *A Business Wrestling with the Problem of Aid to Colleges and Universities.* Copies of this pamphlet, which underlines the difficulty of finding both a novel and satisfactory method of providing aid, are available on request.

HOW THE HEADS OF SOME OF THE INSTITUTIONS TO WHICH McGRAW-HILL HAS MADE GRANTS FEEL ABOUT THE TUITION SUPPLEMENT PLAN

"We are pleased not only because this addition to the never adequate supply of non-earmarked funds is a most welcome one, but also because it attests to the fact that the employees of our neighboring business firms are benefiting from the courses we offer at times convenient for them. We hope this mutually beneficial plan may continue and grow with the years."

Grayson Kirk, President
Columbia University

"I shall take this occasion to express deep sentiments of appreciation, in my own name and in the name of the members of the Board of Trustees, for the very effective manner in which your corporation is aiding higher education by the payments made under your tuition supplement plan. Certainly your action is indicative of the fact that you realize industry and higher education must join forces to preserve the basic American system of free enterprise."

Very Reverend John A. Flynn, C.M.
President, St. John's University

"The growing recognition by business and industry of the financial needs and important services rendered to the community by the colleges and universities is most encouraging, and Temple University is deeply appreciative of the fine support extended through McGraw-Hill's program of supplementary grants."

Robert L. Johnson, President
Temple University

The Plan's Advantages

The main advantages of the tuition supplement plan are:

- **It is simple and easily administered.** Payments can be made when scholarships or tuition refunds are granted, or at another time convenient to the company.
- **It relieves the company of the difficult and sometimes disagreeable task of choosing one college rather than another.** The individual employee makes the choice.
- **It directly serves the interest of the company by encouraging and aiding the institutions where its employees take courses.** In a sense, the company makes contributions in direct proportion to the value it receives in education for its employees.
- **It directly serves the interest of the colleges and universities receiving the grants by getting money to them in the form most appreciated**—unrestricted funds to be used at the discretion of their administrators.

Largely because tuition supplements are unrestricted as to use, this plan enjoys the unqualified approval and gratitude of the schools receiving such aid. This is not true of some of the other plans for granting aid to colleges and universities.

Tuition supplements, of course, can't be regarded as large efforts relative to the need of higher education and the responsibilities of business. But they are a very practical and useful first step, involving almost no problems. If you are not familiar with the idea of supplemental grants, why not discuss it with some of your friends in the field of higher education?

The Price Of Novelty

Our experience with tuition supplements indicates that this is an excellent plan, and we are glad to recommend it to other companies looking for an effective method of providing financial aid to higher education.

At any rate, we hope that business firms will not postpone granting financial aid until they find some novel way of doing it. If they do, it will be another case of too little and too late.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT
McGRAW-HILL PUBLISHING COMPANY, INC.

The Meetings Calendar

NOVEMBER

Atomic Industrial Forum—Annual Meeting, Sheraton-Park Hotel, Washington, D. C., Nov. 2-4.

11th Exposition of the Air Conditioning and Refrigeration Industry—Convention Hall, Atlantic City, N. J., Nov. 2-5.

New Jersey Utilities Association—Annual Meeting, Seaview Country Club, Absecon, N. J., Nov. 4-6.

American Nuclear Society—Winter Meeting, Sheraton-Park Hotel, Washington, D. C., Nov. 4-6.

Pennsylvania Electric Association—Meter Committee, Pick-Roosevelt Hotel, Pittsburgh, Pa., Nov. 5-6; Transmission and Distribution Committee, Penn Alto Hotel, Altoona, Pa., Nov. 12-13.

Pacific Coast Electrical Association—Seventh Biennial Conference, Princess Kaiulani Hotel, Waikiki, Honolulu, Hawaii, Nov. 5-6.

Edison Electric Institute—Accident Prevention Committee, Hotel Dennis, Atlantic City, N. J., Nov. 9-11.

Institute of Radio Engineers—Fourth Instrumentation Conference and Exhibit, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 9-11.

National Electrical Manufacturers Association—Annual Meeting, Traymore Hotel, Atlantic City, N. J., Nov. 9-13.

Electric Council of New England—Third Annual Conference, Hotel Somerset, Boston, Mass., Nov. 12-13.

Conference on the Utilization of Atomic Energy—Second Annual Meeting, A. & M. College of Texas, College Station, Texas, Nov. 12-13.

• **Canadian Electrical Association**—General and Sales Sections' Meetings, Saskatoon, Canada, Nov. 12-14; Engineering section, Calgary, Canada, Nov. 16-18.

American Institute of Electrical Engineers—Appliance Technical Conference, Biltmore Hotel, Los Angeles, Calif., Nov. 16.

Southeastern Electric Exchange—Sales Conference, Roosevelt Hotel, New Orleans, La., Nov. 16-18.

Industrial Electrical Expositions—Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 16-18.

• **Fifth International Automation Congress and Exposition**—New York Trade Show Building, New York City, Nov. 16-20.

• **National Association of Corrosion Engineers**—Fourth Annual General Florida Conference 1959 Corrosion Short Course, Key Biscayne Hotel, Miami, Fla., Nov. 16-20.

• **Sixth Annual National Electric Farm Power Conference**—Sponsored by Inter-Industry Farm Electric Utilization Council, Westward Ho Hotel, Phoenix, Ariz., Nov. 18-20.

• **American Society of Mechanical Engineers**—Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., Nov. 29-Dec. 4.

DECEMBER

• **Eastern Joint Computer Conference**—Statler Hotel, Boston, Mass., Dec. 1-3.

• **American Institute of Mining, Metallurgical, and Petroleum Engineers**—1959 Electric Furnace Conference, Cleveland Hotel, Cleveland, Ohio, Dec. 2-4.

• **Electric Companies Public Information Program**—Steering Committee, Waldorf-Astoria, New York City, Dec. 8.

• **Second National Conference on the Application of Electrical Insulation**—Sponsored by the AIEE & NEMA, Shoreham Hotel, Washington, D. C., Dec. 8-10.

• Additions this week.

Advertising Index

Allen-Bradley Co. 87, 88
Allis-Chalmers Mfg. Co. ..... 2nd Cover
46, 100, 101
Aluminum Co. of America 105, 106,
107, 108
Anaconda Wire & Cable Co. 113

Bartlett Tree Experts 99
Blackburn Corp., Jasper 37
Burndy Corp. ..... 3rd Cover

Chance Co., A. B. 79
Copperweld Steel Co. 19
Cornell-Dubilier Electric Corp. 38

Delta-Star Electric Division,
H. K. Porter Company, Inc. 75
Directory of Engineers 122
Dossert Mfg. Corp. 22
du Pont de Nemours & Co. (Inc.)
Elastomers Chemicals Dept. 24, 25

Engineers, Directory of 122

Fargo Mfg. Co., Inc. 93
Federal Pacific Electric Co. 10
Fisher-Pierce Co. 82

G&W Electric Specialty Co. 84, 85
General Electric Co.
Apparatus Dept. 64, 65, 68, 69, 70, 71
72, 73

Holan Sub. Ohio Brass Co. 116

I-T-E Circuit Breaker Co. 42, 43
Victor Insulators Div. 83
Indiana Steel & Wire Co., Inc. 94

Kaiser Aluminum & Chemical Sales,
Inc. 44, 45
Kearney Corp., James R. 23, 103
Kuhlman Electric Co. ..... 4th Cover

Line Material Industries 27, 28, 29, 30
31, 32, 33, 34, 35

Mallory & Co., Inc., P. R. 118
Minneapolis-Honeywell 6, 90, 91
Moloney Electric Co. 20, 21
Motorola Communications &
Electronics Inc. 36

Ohio Brass Co. 15, 16, 17, 18

Pennsylvania Transformer Div.,
McGraw-Edison Co. 4
Pfaudler Permutit Inc. 95
Preformed Line Products Co. 76, 77

RT&E Corp. 41
Republic Aviation Corp.
Helicopter Div. 26
Roebling's Sons Corp., John A. 40
Royal Electric Mfg. Co., Inc. 115

Sangamo Electric Co. 115, 117, 119, 121
123, 125
Searchlight Section 124
Southern States Equipment Corp. 89
Superior Cable Corp. 86

Texoma Enterprises, Inc. 120

United States Rubber Co. 7

Vita-Var Corp. 39

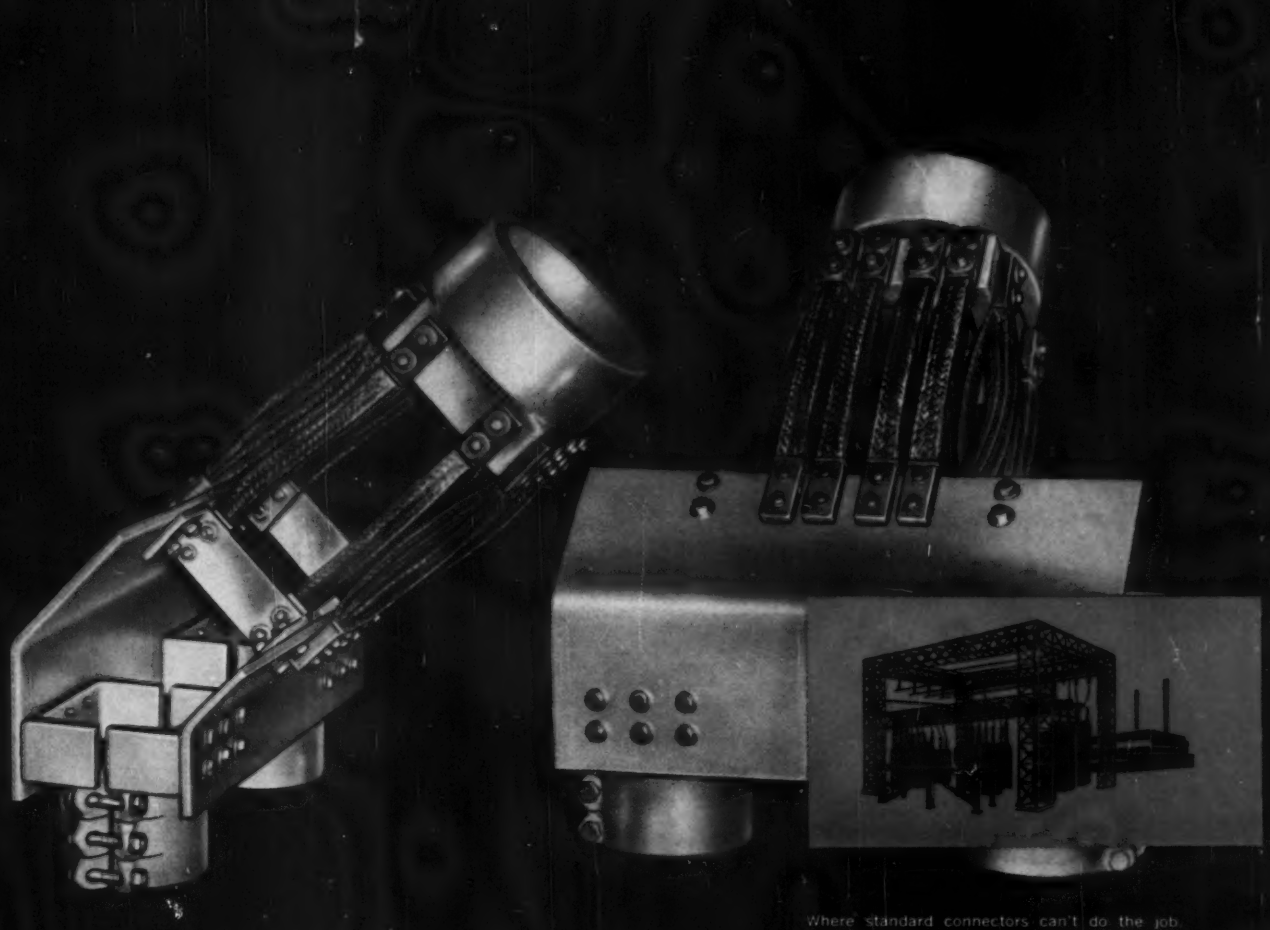
Wagner Electric Corp. 80, 81
Westinghouse Electric Corp. 8, 9, 96, 97

PROFESSIONAL SERVICES 122

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 124

EQUIPMENT
(Used or Surplus New)
For Sale 124



BURNDY DESIGN

Where standard connectors can't do the job, Burndy designs "specials." Shown here is one of three Burndy connectors designed to save 100 lbs. each in weight. Linking aluminum bus to copper studs of 220,000 kva transformer, connectors are flexible, have 45° angle so stud portion can be swung aside when necessary.

concentrates

ON DEVELOPING BETTER ELECTRICAL CONNECTIONS

From generator bus to service drop, the transmission and distribution of electricity depend on the design of the millions of electrical connectors that tie the system together. The design of Burndy connectors is based on 35 years experience with utility practices and with the electrical and mechanical design principles essential to produce dependable electrical connectors.

Burndy has concentrated its extensive design, research, test and production facilities on the development of better electrical connectors, standard as well as special. This unique concentration on the single objective of designing electrical connectors has produced a vast array of special connectors, like the transformer terminal unit illustrated, and whole families of mechanical and compression connectors that simplify the lineman's job, copper-to-aluminum connectors, and low cost connectors for use in great quantities.

DESIGN, RESEARCH, TEST AND PRODUCTION LEADERSHIP

BURNDY

58-17

Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

Here's why you get more for your transformer dollar this year . . .

Lower Losses—Put Less Drain Per Transformer On Your System
Better Regulation—Means Higher Revenue—More Customer Satisfaction

The lower losses and improved performance of the new Kuhlman pole transformers mean lower operating costs for you from generation to ultimate user.

Lower exciting current conserves generating capacity. Lower copper and core losses put less drain on your system. Lower impedance, better regulation mean less loss of power and revenue during heavy loading hours. Take even an average 10% improvement in the above performance and multiply it by the number of transformers in your system and you'll realize the savings that is yours when you specify the *all new* Kuhlman.

Lower exciting current, lower copper and core losses, improved impedance, better regulation, all mean lower operating costs, more revenue, more customer satisfaction. If you have been waiting for the best time to buy—buy now. And buy Kuhlman. There never will be a time when you'll get more for your transformer dollar.

65th year

the great year to get more for your transformer dollars

KUHLMAN POLE TYPE TRANSFORMERS

KUHLMAN ELECTRIC COMPANY General Offices: Birmingham, Michigan
BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA